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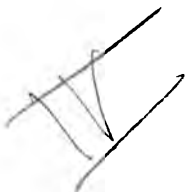
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KEY TO
MILNE'S
PRACTICAL ARITHMETIC





Inductive Series.

KEY

TO THE

PRACTICAL ARITHMETIC

CONTAINING THE SOLUTION

OF THE



MORE DIFFICULT EXAMPLES.

BY

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THIS work is designed to aid the teacher in the preparation of his class exercises, and to assist him in detecting errors in the processes of the pupils. It contains concise analyses and brief solutions of all the difficult problems, thus relieving the instructor from the burdensome necessity of devising forms of analyses for his classes.

Many of the problems can be solved in several ways, but the author has deemed it best to give that form of solution which is most natural to the student, although it may be occasionally longer than some other form.

The student who is pursuing his arithmetical studies without the assistance or direction of an instructor, will be able to economize his time by a judicious use of this work.

W. J. M.

April, 1878.

(III)

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- IV. ELEMENTS OF ALGEBRA.
- V. ELEMENTS OF GEOMETRY. (*In preparation.*)

KEY

TO

MILNE'S PRACTICAL ARITHMETIC.

NOTATION AND NUMERATION.

Page 13.

Example 2. 36,218,846: Thirty-six million, two hundred eighteen thousand, eight hundred forty-six.

3. 84,540,600,040: Eighty-four billion, five hundred forty million, six hundred thousand, forty.

4. 201,075,562,012,001: Two hundred one trillion, seventy-five billion, five hundred sixty-two million, twelve thousand, one.

5. 60,402,333,200,111: Sixty trillion, four hundred two billion, three hundred thirty-three million, two hundred thousand, one hundred eleven.

6. 73214070.

8. 225641351.

7. 80040612788.

9. 354604892036.

Page 14.

1. One hundred sixteen thousand, two hundred thirty-four.

2. Sixty-five thousand, two hundred thirty-one.

(5)

3. Twenty thousand, seven hundred three.
4. Seventy-one thousand, five.
5. Three thousand, one hundred four.
6. Forty-eight thousand.
7. Sixty thousand, twenty-nine.
8. One hundred forty-one thousand, one hundred twenty.
9. One hundred one thousand, two hundred seven.
10. Sixty-eight thousand, nine hundred seventy-eight.
11. Seventy-two thousand, twenty.
12. Eighty thousand, one.
13. Eight hundred fifty-seven thousand.
14. Ninety-one thousand, twenty-nine.
15. Seven thousand, six hundred forty.
16. Eight hundred thousand, nine hundred.
17. Two million, five hundred sixty-eight thousand, two hundred forty-two.
18. One million, eight thousand, three.
19. Two hundred twelve million, three hundred seventy-five thousand, six hundred forty-seven.
20. Six hundred nine million, three thousand, five hundred eighty-eight.
21. Eight hundred ninety-seven million, eight hundred fifty-six thousand, eight hundred forty-six.
22. 200 : Two hundred.
23. 60,002 : Sixty thousand, two.

24. 700,000,000 : Seven hundred million.
25. 230,000,060 : Two hundred thirty million, sixty.
26. 81,501,007,012 : Eighty-one billion, five hundred one million, seven thousand, twelve.
27. 30,000,000,000,603 : Thirty trillion, six hundred three.
28. 700,080,000,000,000 : Seven hundred trillion, eighty billion.
29. 8,007,014,010 : Eight billion, seven million, fourteen thousand, ten.
30. 15,000,018,207,000,081 : Fifteen quadrillion, eighteen billion, two hundred seven million, eighty-one.

Page 15.

1. Sixty million, seven hundred one thousand, eight hundred ninety-two.
2. Fifty million, six hundred seven thousand, eight hundred one.
3. Six hundred thousand.
4. Forty-nine million.
5. Five hundred ninety-three billion, six million, seventy thousand, five hundred.
6. Nineteen quadrillion, nineteen trillion, one hundred ninety million, nineteen thousand, nineteen.
7. One hundred sixty-three million, one hundred ninety-four thousand, five hundred sixty-eight.
8. Three billion, fifty million, fifty thousand, one hundred eighty-three.

3. Twenty thousand, seven hundred three.
4. Seventy-one thousand, five.
5. Three thousand, one hundred four.
6. Forty-eight thousand.
7. Sixty thousand, twenty-nine.
8. One hundred forty-one thousand, one hundred twenty.
9. One hundred one thousand, two hundred seven.
10. Sixty-eight thousand, nine hundred seventy-eight.
11. Seventy-two thousand, twenty.
12. Eighty thousand, one.
13. Eight hundred fifty-seven thousand.
14. Ninety-one thousand, twenty-nine.
15. Seven thousand, six hundred forty.
16. Eight hundred thousand, nine hundred.
17. Two million, five hundred sixty-eight thousand, two hundred forty-two.
18. One million, eight thousand, three.
19. Two hundred twelve million, three hundred seventy-five thousand, six hundred forty-seven.
20. Six hundred nine million, three thousand, five hundred eighty-eight.
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2. Fifty million, six hundred seven thousand, eight hundred one.
3. Six hundred thousand.
4. Forty-nine million.
5. Five hundred ninety-three billion, six million, seventy thousand, five hundred.
6. Nineteen quadrillion, nineteen trillion, one hundred ninety million, nineteen thousand, nineteen.
7. One hundred sixty-three million, one hundred ninety-four thousand, five hundred sixty-eight.
8. Three billion, fifty million, fifty thousand, one hundred eighty-three.

9. Five million, two hundred four.
10. Five hundred ninety-four thousand, nine hundred.
11. Twelve million, twelve.
12. Two hundred trillion, seven hundred ninety-eight billion, thirteen million, four hundred thousand, nineteen.
13. Two hundred twelve quintillion, five hundred six quadrillion, sixty-seven trillion, ninety-three billion, twelve million, sixty-three thousand, sixty-seven.

- | | |
|---------------------|--------------------|
| 14. 2060153. | 21. 402348213020. |
| 15. 60060060060. | 22. 5268949. |
| 16. 60200500. | 23. 200300800. |
| 17. 402348213020. | 24. 29599000601. |
| 18. 78640009006016. | 25. 4000558244070. |
| 19. 6542000025. | 26. 32061343404. |
| 20. 6542000025. | 27. 555777669. |

28. 806070385206.

Page 16.

- | | |
|------------------------|------------------|
| 29. 941000000116022. | 31. 600075. |
| 30. 23023023023. | 32. 12008988013. |
| 33. 29757000480013565. | |

Page 17.

- | | |
|---------------|------------------|
| 1. \$2.235. | 5. \$20000.32. |
| 2. \$202.025. | 6. \$12700000. |
| 3. \$112.25. | 7. \$6000000.88. |
| 4. \$602.09. | 8. \$12300.15. |

Page 18.

Fifteen; twenty-four; thirty-nine; forty; forty-nine; ninety-nine; seventy-seven; three hundred eighty-nine; seven hundred thirty-six; five thousand, five hundred fifty-five; five hundred fifty thousand, six hundred; two hundred ten thousand, five hundred six; seventy-three thousand, eight hundred ninety-nine; one million, five hundred ninety-five thousand, eight hundred sixty-four.

XV; XVIII; XXVII; LXXXI; XCV; LXXXVI; DXXXIV; DCLXXXIV; ML; VIIIIV; VII; LXXVDCCCLXIX.

SUBTRACTION.**Page 41.**

33. $297 + 308 = 605$ mi.; $861 - 605 = 256$ mi., *Ans.*

34. $\$584 + \$759 + \$463 = \1806 ;
 $\$1806 - \$1298 = \$508$, *Ans.*

Page 42.

35. $1235 + 1317 = 2552$ pounds;
 $3715 - 2552 = 1163$ pounds, *Ans.*

36. $\$637 + \$317 = \$954$;
 $\$729 + \$356 = \$1085$;
 $\$1085 - \$954 = \$131$ gain, *Ans.*

37. $1317 + 2357 = 3674$ bricks in first two;
 $3674 - 1719 = 1955$ bricks in third, *Ans.*
38. $874,120,005 - 264,146,900 = 609,973,105$ bu., *Ans.*
39. $351 + 27 = 378$ acres, B's land;
 $537 - 378 = 159$ acres C had at first, *Ans.*
40. $\$308.40 - \$106.28 = \$202.12$, cost, *Ans.*
41. $1870 - 378 = 1492$, *Ans.*
42. $\$2191 + \$3256 = \$5447$, total deposited;
 $\$3412 + \$2164 = \$5576$, total drawn out;
 $\$5576 - \$5447 = \$129$ more drawn than deposited;
 $\$1826 - \$129 = \$1697$ on hand Wednesday morning.
43. $\$2895 + \$3864 = \$6759$;
 $\$15795 - \$6759 = \$9036$ invested in land, *Ans.*
44. $68754 - 56849 = 11905$;
 $89346 - 68754 = 20592$;
 $20592 - 11905 = 8687$, *Ans.*
45. $38944 - 35442 = 3502$ pupils, *Ans.*
-

MULTIPLICATION.

Page 55.

1. $896 \times 58 = 51968$ lb.; $\$.63 \times 51968 = \32739.84 .
2. $\$3.50 \times 3923 = \13730.50 , *Ans.*
3. $119 \times 6 = 714$ bu.; $714 + 515 = 1229$ bu., *Ans.*
4. $64 \times 113 = 7232$; $47 \times 7232 = 339904$ yd., *Ans.*

5. $\$85 \times 25 = \2125 ;
 $\$4.50 \times 316 = \1422 ;
 $\$8 \times 94 = \752 ;
 $\$2125 + \$1422 + \$752 = \4299 , *Ans.*
6. $\$3750 + \$4650 = \$8400$;
 $\$8400 = 84$ hundred dollars;
 $\$2 \times 84 = \168 , *Ans.*
7. $47 \times 219 = 10293$ bu., *Ans.*
8. $6 \times 2 = 12$ quills furnished by each goose;
 $12 \times 398 = 4776$ quills, *Ans.*
9. $\$.26 \times 81 = \21.06 ;
 $\$.28 \times 53 = \14.84 ;
 $\$21.06 + \$14.84 = \$35.90$, *Ans.*

Page 56.

10. $1716 \times 4 = 6864$ pickets for one lot;
 $6864 \times 13 = 89232$ pickets for all, *Ans.*
11. $56 \times 13 = 728$; $\$.34 \times 728 = \247.52 , *Ans.*
12. $10 \times 13 = 130$ tons;
 $\$6.85 \times 130 = \890.50 , cost;
 $\$7 \times 48 = \336 ;
 $\$8.25 \times 28 = \231 ;
 $\$8.75 \times 27 = \236.25 ;
 $48 + 28 + 27 = 103$;
 $130 - 103 = 27$ tons;
 $\$9.50 \times 27 = \256.50 ;
 $\$336 + \$231 + \$236.25 + \$256.50 = \$1059.75$, selling price;
 $\$1059.75 - \$890.50 = \$169.25$ profit, *Ans.*

13. $315 + 417 = 732$;
 $732 \times 13 = 9516$, enemy's loss;
 $9516 + 732 = 10248$, total loss, *Ans.*
14. $18 \times 36 = 648$ miles sailed by first;
 $15 \times 36 = 540$ miles sailed by second;
 $648 - 540 = 108$ miles apart, *Ans.*
15. $\$.65 \times 350 = \227.50 ;
 $\$1.35 \times 215 = \290.25 ;
 $\$.43 \times 273 = \117.39 ;
 $\$227.50 + \$290.25 + \$117.39 = \635.14 , *Ans.*
16. $\$65.50 \times 325 = \21287.50 ;
 $\$3.25 \times 345 = \1121.25 ;
 $\$2684.95 + \$1121.25 = \$3806.20$;
 $\$21287.50 - \$3806.20 = \$17481.30$, *Ans.*
17. $\$1.75 \times 28 \times 17 = \833 ;
 $\$1.85 \times 29 \times 23 = \1233.95 ;
 $\$833 + \$1233.95 = \$2066.95$, *Ans.*
18. $\$3.25 \times 37 \times 13 = \1563.25 , *Ans.*
-

DIVISION.

Page 68.

48. $6318 \div 39 = 162$ lots, *Ans.*
49. $\$4386 \div 17 = \258 , *Ans.*
50. $41600 \div 320 = 130$ mi., *Ans.*
51. $\$6.84 \div \$.38 = 18$ doz., *Ans.*

52. $60 \times 24 = 1440$, minutes in 24 hours;
 $1575000 \div 1440 = 1093\frac{1000}{1440}$ mi. per minute, *Ans.*
53. $29100 \div 5280 = 5\frac{7700}{5280}$ mi., *Ans.*
54. $5 \times 5 = 25$, number of loads drawn per day;
 $25 \times 1250 = 31250$ bricks drawn per day;
 $4375480 \div 31250 = 140$ da.; 480 bricks left, *Ans.*
55. $91500000 \div 185000 = 494\frac{100000}{185000}$ sec., *Ans.*
56. $\$63 \times 278 = \17514 ;
 $\$17514 - \$1275 = \$16239$, amount unpaid;
 $\$16239 \div 8 = \$2029\frac{7}{8}$, each annual payment, *Ans.*
57. $\$3681452 \div 365 = \$10086\frac{62}{365}$, av. da. income, *Ans.*
58. $221760 \div 42 = 5280$ ft., *Ans.*
59. $\$50000 \div \$500 = 100$, number of men, *Ans.*
60. $1071400 \div 50704 = 21\frac{6616}{50704}$, average number, *Ans.*

ANALYSIS AND REVIEW.

Page 72.

11. $(12 + 7 - 9) = 10$; $10 \times 5 = 50$, *Ans.*
12. $(13 - 6 + 8) = 15$; $15 \times 6 = 90$, *Ans.*
13. $(11 - 2 + 5) = 14$; $14 \times 8 = 112$, *Ans.*
14. $(3 + 4) \times 9 = 63$; $(3 + 6) \div 3 = 3$;
 $63 - 3 = 60$, *Ans.*
15. $(5 + 7 - 3) \times 3 = 27$; $(3 + 5 - 4) \div 4 = 1$;
 $27 + 1 = 28$, *Ans.*

16. $(36 - 7) \times 5 = 145$; $(102 + 6) \div 9 = 12$;
 $145 + 12 = 157$, *Ans.*
17. $(99 - 3) \div 8 = 12$; $(86 + 10) \div 12 = 8$;
 $(3 + 6) \div 3 = 3$; $12 - 8 + 3 = 7$, *Ans.*
18. $(45 + 3) \div 6 = 8$; $(10 + 15) \div (7 - 2) = 25 \div$
 $5 = 5$; $8 + 5 + 6 = 19$, *Ans.*
9. 1118 A. = 1st tract;
 3 times 1118 — 193 = 3161 A. = 2d tract;
 2 times (1118 + 3161) — 105 = 8453 A. = 3d tract;
 1118 + 3161 + 8453 = 12732 A.;
 $12732 \div 5 = 2546\frac{2}{5}$ A., the share of each, *Ans.*

Page 73.

20. $\$39 \times 1516 = \59124 , what he paid for cattle;
 $\$59124 + \$1819 = \$60943$, what he sold them for;
 $1516 - 97 = 1419$, number of cattle sold;
 $\$60943 \div 1419 = \$42\frac{445}{1419}$, the price per head, *Ans.*
21. $\$30 - (\$7.25 + \$4.25) = \18.50 , his weekly savings;
 $\$1500 \div \$18.50 = 81\frac{150}{1850}$ weeks, *Ans.*
22. $\$115 + \$30 = \$145$, entire expense of horse;
 $\$155 + \$50 = \$205$, entire returns from horse;
 $\$205 - \$145 = \$60$, gain, *Ans.*
23. $\$9215 - \$8735 = \$480$, the entire gain;
 $\$480 \div \$.25 = 1920$, the number of bushels, *Ans.*
24. $\$200 + \$50 = \$250$, the entire selling price;
 $\$250 \div 25 = \10 , the selling price per barrel;
 $\$10 - \8 , first cost, = $\$2$, gain per bbl., *Ans.*

25. Since a yard of both kinds of cloth would cost him \$13, he could buy a yard of both kinds as many times as \$13 are contained times in \$585, which is 45 times; therefore he bought 45 yd. of each, *Ans.*
26. $48 + 52 = 100$ mi., the distance apart each day;
 $100 \text{ mi.} \times 5 = 500$ mi., the whole distance, *Ans.*
27. $31 \times 20 = 620$, No. days required for 1 man to do it;
 $620 \div 31 = 20$, No. days it will take 31 men to do it.
28. $\$3.50 \times 16 = \56 , am't received for apples;
 $\$120 - \$56 = \$64$, am't to be realized from barley;
 $\$64 \div \$.80 = 80$, number of bushels of barley, *Ans.*

Page 74.

29. $\$9600 \div \$120 = 80$, number of acres sold first;
 $140 - 80 = 60$, number of acres sold at cost;
 $\$17500 \div 140 = \125 , cost per acre;
 $\$125 \times 60 = \7500 , amount of second sale;
 $\$9600 + \$7500 = \$17100$, am't for which it was sold;
 $\$17500 - \$17100 = \$400$ loss, *Ans.*
30. $\$628 + \$350 + \$262 + \$700 + \$175 = \2115 , his annual expenses;
 $\$2115 \times 4 = \8460 , expenses for 4 years;
 $\$53 \times 130 = \underline{\$6890}$, entire savings in 4 years;
 $\$15350$, entire earnings in 4 years.
 $\$15350 \div 4 = \3837.50 , his annual income, *Ans.*
31. $\$196,000,000 \div 2124 = \$92278\frac{1523}{2124}$, the average loss per acre, *Ans.*
32. $140 \div 4 = 35$, number of rods he can run per min.;
 $630 \div 35 = 18$, number of minutes required, *Ans.*

33. $315 + 175 + 300 = 790$, number in the three fields;
 $1000 - 790 = 210$, number equally distributed in the
 other two fields; therefore,
 $210 \div 2 = 105$, the number in the fifth field, *Ans.*
34. $\$45000 \div 3 = \15000 , amount given to grandchildren;
 $\$15000 \div \$1500 = 10$, number of grandchildren, *Ans.*
35. $22,300,000 \div 6000 = 3716\frac{1000}{3}$ pounds, *Ans.*
36. $872,320 + 37,344 + 26,344 = 936,008$, entire area;
 $936,008 \div 43,560 = 21\frac{21248}{43560}$, number of acres, *Ans.*

DIVISION BY FACTORS.

Page 81.

14. The factors of 72 are 8 and 9.

$$\begin{array}{r} 8 \overline{) 3528} \\ 9 \overline{) 441} \\ \hline 49 \end{array}$$

Quotient, 49.

15. The factors of 32 are 4 and 8.

$$\begin{array}{r} 4 \overline{) 3824} \\ 8 \overline{) 956} \\ \hline 119 \dots 4 \text{ Rem.} \end{array}$$

$4 \times 4 = 16$, true Rem.

Quotient, $119\frac{4}{8}$.

16. The factors of 49 are 7 and 7.

$$\begin{array}{r} 7 \overline{) 2184} \\ 7 \overline{) 312} \\ \hline 44 \dots 4 \text{ Rem.} \end{array}$$

$4 \times 7 = 28$, true Rem.

Quotient, $44\frac{4}{7}$.

17. The factors of 56 are 7 and 8.

$$\begin{array}{r} 7 \overline{) 3275} \\ 8 \overline{) 467} \dots 6 \text{ Rem.} \\ 58 \dots 3 \text{ Rem.} \end{array} \quad \begin{array}{l} 3 \times 7 = 21; \\ 21 + 6 = 27, \text{ true Rem.} \\ \text{Quotient, } 58\frac{3}{8}. \end{array}$$

18. The factors of 27 are 3, 3, and 3.

$$\begin{array}{r} 3 \overline{) 3276} \\ 3 \overline{) 1092} \\ 3 \overline{) 364} \\ 121 \dots 1 \text{ Rem.} \end{array} \quad \begin{array}{l} 1 \times 3 \times 3 = 9, \text{ true Rem.} \\ \text{Quotient, } 121\frac{1}{3}. \end{array}$$

19. The factors of 45 are 3, 3, and 5.

$$\begin{array}{r} 3 \overline{) 4104} \\ 3 \overline{) 1368} \\ 5 \overline{) 456} \\ 91 \dots 1 \text{ Rem.} \end{array} \quad \begin{array}{l} 1 \times 3 \times 3 = 9, \text{ true Rem.} \\ \text{Quotient, } 91\frac{1}{5}. \end{array}$$

20. The factors of 24 are 2, 2, 2, and 3.

$$\begin{array}{r} 2 \overline{) 7304} \\ 2 \overline{) 3652} \\ 2 \overline{) 1826} \\ 3 \overline{) 913} \\ 304 \dots 1 \text{ Rem.} \end{array} \quad \begin{array}{l} 1 \times 2 \times 2 \times 2 = 8, \text{ true Rem.} \\ \text{Quotient, } 304\frac{1}{8}. \end{array}$$

Page 82.

21. $1120 \div 5 = 224$, number of canisters;
 $224 \div 7 = 32$, number of packages, *Ans.*

22. $912 \div 6 = 152$, number of packages;
 $152 \div 4 = 38$, number of quires, *Ans.*
 2

CANCELLATION.**Page 84.**

$$16. \frac{4 \times 80 \times \$65}{5 \times 95} = \$431\frac{1}{5}, \text{ the price per acre, } Ans.$$

$$17. \frac{3 \times 44 \times \$.11}{\$2.00} = 71\frac{3}{5}, \text{ the number of bushels, } Ans.$$

$$18. \frac{13 \times 39 \times \$.32}{4 \times 13} = \$3.12, \text{ the price per yard, } Ans.$$

GREATEST COMMON DIVISOR.**Page 87.**

20. The widest flagging that will suit all the walks will be equal to the greatest common divisor of the given widths, which is 14 inches, *Ans.*

Page 88.

21. The largest packages will be equal to the greatest common divisor of the given amounts of tea, which is 5 pounds, *Ans.*
22. The largest equal fields that can be formed from 324 acres and 78 acres will be equal to the greatest common divisor of these numbers, which is 6 acres. There will therefore be 54 fields in one farm and 13 in the other, or 67 fields in both, *Ans.*

LEAST COMMON MULTIPLE.**Page 91.**

- 30.** The box must be some number of times 6 inches, 8 inches and 12 inches in length, or a common multiple of those numbers, which is 24 inches, *Ans.*
- 31.** It must contain a number of yards which is some number of times 4, 5 and 6 yards, or a common multiple of those numbers, which is 60 yards, *Ans.*
- 32.** The number of pennies must be some number of times 4, 6, 8, 10 and 12, or the least common multiple of those numbers, which is 120 pennies, *Ans.*
- 33.** The number of bushels in the bin will be equal to the least common multiple of 7, 10 and 30, which is 210 bushels, *Ans.*
- 34.** The next time when they will again start out together must be a number of times 8, 9, 15 and 20 weeks, or the least common multiple of those numbers, which is 360 weeks, *Ans.*

Page 92.

- 35.** A walks around the island in 24 days, B in 20 days, and C in 15 days, and therefore the time that will elapse before they are all together again will be some number of times 24, 20 and 15 days, or 120 days, *Ans.*
- 37.** The length of the longest boards will be equal to the greatest common divisor of 48, 60, 96 and 108 feet, which is 12 feet, *Ans.*

39. The smallest number that will contain 250, 350 and 525 is their least common multiple, which is 5250, which must be increased by 25, since there is to be a remainder of 25. Therefore the answer is 5275.
41. The amount to be invested in each will be the least common multiple of the given numbers, which is \$336.
42. If 9 is added to the least common multiple of 24, 28, 32 and 36, the result will be a multiple of 25. The least common multiple of those numbers is 2016, to which 9 is to be added, making 2025, *Ans.*
43. The size of the largest lots will be equal to the greatest common divisor of the numbers 152, 288 and 184 rods, which is 8 rods, *Ans.*

ADDITION OF FRACTIONS.

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11. $\frac{4}{7} + \frac{15}{11} + \frac{13}{14} + \frac{5}{28} + \frac{7}{35} = \frac{240}{420} + \frac{390}{420} + \frac{390}{420} + \frac{75}{420} + \frac{84}{420} = \frac{2499}{420}$, or $2\frac{83}{140}$, *Ans.*
12. $\frac{3}{4} + \frac{2}{5} + \frac{1}{6} + \frac{3}{8} + \frac{1}{3} + \frac{3}{7} = 2\frac{25}{115}$, or $1\frac{12}{23}$;
 $4 + 5 + 8 + 2 + 7 + 4 = 30$
 Sum = $32\frac{2}{3}$, *Ans.*
13. $\frac{1}{4} + \frac{3}{8} + \frac{2}{3} + \frac{5}{12} + \frac{5}{20} = 2\frac{11}{10}$
 $9 + 7 + 8 + 7 + 8 = 39$
 Sum = $41\frac{11}{10}$, *Ans.*

$$14. \frac{4}{18} + \frac{5}{12} + \frac{7}{60} + \frac{4}{78} = \frac{928}{1170}, \text{ or } \frac{512}{675};$$

$$7 + 8 + 6 + 3 + 5 = 29$$

$$\text{Sum} = 29\frac{512}{675}, \text{ Ans.}$$

$$15. \frac{2}{11} + \frac{1}{16} + \frac{3}{11} + \frac{5}{44} + \frac{13}{11} = 1\frac{360}{154}$$

$$2 + 3 + 2 = 7$$

$$\text{Sum} = 8\frac{360}{154}, \text{ Ans.}$$

$$16. \frac{5}{9} + \frac{7}{18} + \frac{3}{18} + \frac{5}{27} = 1\frac{221}{162}$$

$$3 + 4 + 6 + 9 = 22$$

$$\text{Sum} = 23\frac{221}{162}, \text{ Ans.}$$

$$17. \text{ He received the sum of } \$18\frac{3}{4}, \$65\frac{3}{4} \text{ and } \$161\frac{3}{4}.$$

$$\$ \frac{3}{4} + \$ \frac{3}{4} + \$ \frac{3}{4} = \$2\frac{3}{4}, \text{ or } \frac{1}{10};$$

$$\$18 + \$65 + \$161 = \$244$$

$$\text{Sum} = \$246\frac{1}{10}, \text{ Ans.}$$

$$18. \text{ They all earn the sum of } \$67\frac{5}{8}, \$23\frac{3}{4} \text{ and } \$23\frac{3}{4}.$$

$$\$ \frac{5}{8} + \$ \frac{3}{4} + \$ \frac{3}{4} = \$2\frac{1}{8}$$

$$\$67 + \$23 + \$23 = \$113$$

$$\text{Sum} = \$115\frac{1}{8}, \text{ Ans.}$$

$$19. \text{ He walked the sum of } 45\frac{2}{3} \text{ mi., } 47\frac{2}{3} \text{ mi. and } 50\frac{2}{3} \text{ mi.}$$

$$\frac{2}{3} + \frac{2}{3} + \frac{2}{3} = 1\frac{2}{3}$$

$$45 + 47 + 50 = 142$$

$$\text{Sum} = 143\frac{2}{3}, \text{ Ans.}$$

20. Since B has $10\frac{2}{3}$ acres more than A, he has the sum of $5\frac{1}{4}$ and $10\frac{2}{3}$ acres, which is $15\frac{1}{12}$ acres. Since C has as much as A and B, he has the sum of $5\frac{1}{4}$ and $15\frac{1}{12}$ acres, which is $21\frac{2}{3}$ acres. The sum of B's and C's will be the sum of $15\frac{1}{12}$ and $21\frac{2}{3}$, which is $36\frac{1}{6}$ acres, *Ans.*

SUBTRACTION OF FRACTIONS.**Page 109.**

$$15. \quad 10\frac{1}{4} = 10\frac{5}{20}$$

$$\frac{1}{5} = \frac{4}{20}$$

$$\text{Rem.} = 10\frac{10}{20}, \text{ or } 10\frac{1}{2}, \text{ Ans.}$$

$$16. \quad 66\frac{2}{5} = 66\frac{4}{10}$$

$$33\frac{1}{3} = 33\frac{4}{12}$$

$$\text{Rem.} = 33\frac{1}{6}, \text{ Ans.}$$

$$17. \quad 210\frac{1}{2} = 210\frac{9}{18} = 209\frac{17}{18}$$

$$109\frac{5}{9} = 109\frac{10}{18} = 109\frac{10}{18}$$

$$\text{Rem.} = 100\frac{7}{9}, \text{ Ans.}$$

$$18. \quad 112 = 111\frac{2}{2}$$

$$75\frac{1}{2} = 75\frac{1}{2}$$

$$\text{Rem.} = 36\frac{1}{2}, \text{ Ans.}$$

$$19. \quad 606\frac{3}{4} = 606\frac{3}{4}$$

$$70\frac{1}{2} = 70\frac{2}{4}$$

$$\text{Rem.} = 536\frac{1}{4}, \text{ Ans.}$$

$$20. \quad 589\frac{3}{4} = 589\frac{6}{8} = 588\frac{14}{8}$$

$$67\frac{3}{4} = 67\frac{6}{8} = 67\frac{6}{8}$$

$$\text{Rem.} = 521\frac{1}{2}, \text{ Ans.}$$

$$21. \quad \text{There is left the difference between } 506\frac{3}{4} \text{ T. and } 418\frac{1}{2} \text{ T.}$$

$$506\frac{3}{4} = 506\frac{3}{4} \text{ T.}$$

$$418\frac{1}{2} = 418\frac{2}{4} \text{ T.}$$

$$\text{Dif.} = 88\frac{1}{4} \text{ T., Ans.}$$

22. She paid for the articles purchased the sum of $\$2\frac{1}{2}$, $\$15\frac{3}{4}$ and $\$3\frac{1}{4}$, which is $\$22$. Therefore, $\$25 - \$22 = \$3$, the amount she had left, *Ans.*

23. He sold the sum of $60\frac{2}{3}$ A., $45\frac{1}{2}$ A. and $116\frac{1}{3}$ A., which is $222\frac{1}{2}$ A. Therefore he had left the difference between 412 and $222\frac{1}{2}$ A.

$$412 = 411\frac{2}{3} \text{ A.}$$

$$222\frac{1}{2} = \underline{222\frac{1}{2}} \text{ A.}$$

$$\text{Dif.} = 189\frac{1}{2} \text{ A., } \textit{Ans.}$$

24. His entire expenses were equal to the sum of $\$20\frac{1}{4}$, $\$5\frac{1}{4}$ and $\$4\frac{3}{4}$, which is $\$31\frac{1}{10}$. Therefore,

$$\$50\frac{1}{2} - \$31\frac{1}{10} = \text{the amount saved ;}$$

$$\$50\frac{1}{2} = \$50\frac{5}{10}$$

$$\$31\frac{1}{10} = \underline{\$31\frac{1}{10}}$$

$$\text{Dif.} = \$19\frac{4}{10}, \text{ or } \$19\frac{2}{5}, \textit{Ans.}$$

MULTIPLICATION OF FRACTIONS.

Page 114.

24. The product is equal to $\frac{5}{9} \times \frac{3}{4} \times \frac{5}{7} \times \frac{3}{11} \times \frac{8}{9} \times \frac{7}{2}$, which, cancelling, becomes $\frac{100}{88} = 3\frac{1}{8}$, *Ans.*

25. The product is equal to $\frac{3}{5} \times \frac{7}{12} \times \frac{8}{9} \times \frac{5}{7} \times \frac{9}{10} \times \frac{15}{17}$, which, cancelling, becomes $\frac{27}{2} = 27$, *Ans.*

26. The product is equal to $\frac{7}{2} \times \frac{3}{4} \times \frac{4}{7} \times \frac{3}{4} \times \frac{7}{7}$, which, cancelling, becomes $\frac{9}{2} = 31\frac{1}{2}$, *Ans.*

27. The product is equal to $2\frac{1}{4} \times \frac{7}{8} \times \frac{1^8}{1} \times \frac{5}{6} \times \frac{3}{4} \times \frac{1}{5} \times \frac{4}{1}$, which, cancelling, becomes $14\frac{7}{8} = 14\frac{7}{8}$, *Ans.*
28. The cost will be $\frac{9}{10}$ of $\$8\frac{5}{8}$, which is $\$3\frac{3}{4}$, *Ans.*
29. There are $5\frac{1}{2}$ times $16\frac{1}{2}$ ft. $1\frac{1}{2} \times \frac{3^3}{2} = \frac{3^3}{2} = 90\frac{3}{4}$ ft.
30. He sold $\frac{3}{8}$ of $\frac{5}{7}$, or $\frac{3}{7}$ of the mill, *Ans.*
31. There are $12\frac{1}{2}$ times $42\frac{3}{4}$ yards. $\frac{3^5}{2} \times \frac{17^1}{4} = \frac{427^5}{8} = 534\frac{3}{8}$ yd., *Ans.*
32. The amount realized will be $4\frac{1}{2}$ times $\$16\frac{7}{8}$. $\frac{2^4}{5} \times \frac{13^5}{8} = \81 , *Ans.*

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33. $\frac{3}{8} \times \frac{9}{11} \times \frac{10}{11} \times \frac{2}{25} \times \frac{1^5}{1} = \frac{432}{385} = 1\frac{47}{385}$, *Ans.*
34. $\frac{8}{17} \times \frac{31}{9} \times \frac{34}{49} \times \frac{2^2}{1} = \frac{14384}{441} = 32\frac{72}{441}$, *Ans.*

DIVISION OF FRACTIONS.**Page 121.**

15. The quotient is equal to $\frac{3}{7} \times \frac{5}{8} \times \frac{1^6}{1} \times \frac{5}{8} \times \frac{7}{6} \times \frac{3}{16} = \frac{7^5}{16} = 1\frac{9}{16}$, *Ans.*
16. The quotient is equal to $\frac{5}{9} \times \frac{1^2}{3} \times \frac{1^6}{3} \times \frac{1^8}{18} \times \frac{5}{1} \times \frac{1}{18} = \frac{5}{27}$, *Ans.*
17. The quotient is equal to $\frac{7}{8} \times \frac{3}{4} \times \frac{3}{7} \times \frac{7}{7} \times \frac{4}{8} = \frac{7}{8} = 2\frac{1}{8}$, *Ans.*
18. The quotient is equal to $\frac{1}{8} \times \frac{5}{8} \times \frac{9}{11} \times \frac{1}{5} \times \frac{8}{8} \times \frac{7}{8} = \frac{7}{66}$, *Ans.*

19. The quotient is equal to $\frac{3}{5} \times \frac{7}{8}$ of $\frac{15}{1} \times \frac{5}{2} \times \frac{2}{5} \times \frac{1}{3} = \frac{5}{8} = 2\frac{5}{8}$, *Ans.*
20. The quotient is equal to $\frac{5}{8} \times \frac{6}{11} \times \frac{22}{1} \times \frac{10}{8} \times \frac{7}{5} \times \frac{1}{16} = \frac{75}{16} = 2\frac{3}{16}$, *Ans.*
21. The quotient is equal to $\frac{3}{14} \times \frac{1}{8} \times \frac{4}{1} \times \frac{7}{4} \times \frac{1}{6} \times \frac{7}{5} = \frac{1}{4}$, *Ans.*
22. The quotient is equal to $\frac{3}{4} \times \frac{1}{3} \times \frac{7}{1} \times \frac{4}{5} \times \frac{3}{2} \times \frac{1}{5} = \frac{7}{10} = 7\frac{7}{10}$, *Ans.*
23. As many pieces as $\frac{2}{15}$ of a yard is contained times in $\frac{1}{2}$ of $\frac{9}{10}$ of a yard. $\frac{1}{2}$ of $\frac{9}{10} \div \frac{2}{15} = \frac{1}{2} \times \frac{9}{10} \times \frac{15}{2} = \frac{27}{8} = 3\frac{3}{8}$ pieces, *Ans.*
24. He will spend $\$17\frac{1}{2}$ in as many days as $\$3\frac{2}{3}$ is contained times in $\$17\frac{1}{2}$. $17\frac{1}{2} \div 3\frac{2}{3} = \frac{35}{2} \times \frac{3}{5} = \frac{105}{2} = 26\frac{1}{2}$ da.
25. As many yards as $\$3\frac{2}{3}$ are contained times in $\$317\frac{3}{4}$. $317\frac{3}{4} \div 3\frac{2}{3} = \frac{953}{4} \times \frac{3}{5} = \frac{2859}{4} = 93\frac{3}{4}$ yd., *Ans.*

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26. As many bushels as $\$3\frac{2}{3}$ is contained times in $\$17\frac{1}{4}$. $17\frac{1}{4} \div 3\frac{2}{3} = \frac{69}{4} \times \frac{3}{5} = 46$ bu., *Ans.*
27. As many weeks as $\frac{2}{3}$ of a barrel is contained times in $5\frac{1}{4}$ barrels. $5\frac{1}{4} \div \frac{2}{3} = \frac{21}{4} \times \frac{3}{2} = \frac{63}{8} = 7\frac{7}{8}$ wk., *Ans.*
28. As many days as $\$3\frac{2}{3}$ is contained times in $\$35\frac{5}{6}$. $35\frac{5}{6} \div 3\frac{2}{3} = \frac{22}{3} \times \frac{3}{5} = \frac{22}{5} = 8\frac{2}{5}$ da., *Ans.*
29. Since the number when multiplied by $\frac{3}{7}$ gives a product of $\frac{21}{5}$, $\frac{21}{5} \div \frac{3}{7}$ will give the number. $\frac{21}{5} \div \frac{3}{7} = \frac{21}{5} \times \frac{7}{3} = \frac{49}{5} = 9\frac{4}{5}$ the number, *Ans.*
30. As many days as $1\frac{1}{4}$ cords are contained times in $17\frac{1}{2}$ cords. $17\frac{1}{2} \div 1\frac{1}{4} = \frac{35}{2} \times \frac{4}{3} = \frac{70}{3} = 23\frac{1}{3}$ da., *Ans.*

31. Since there are 35 days in 5 weeks, the horse will eat $\frac{1}{35}$ of $12\frac{1}{2}$ bushels daily. $\frac{1}{35}$ of $12\frac{1}{2}$ bu. = $\frac{1}{35}$ of $\frac{25}{2}$ bu. = $\frac{5}{14}$ bu., *Ans.*
32. As many bushels can be bought for \$3168 as \$1 $\frac{7}{8}$ are contained times in \$3168. $3168 \div 1\frac{7}{8} = \frac{2168}{1} \times \frac{8}{15} = \frac{2448}{5} = 1689\frac{3}{5}$ bu., *Ans.*

FRACTIONAL FORMS.

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2. $\frac{5}{9} = \frac{5}{9} \div 9 = \frac{5}{9} \times \frac{1}{9} = \frac{5}{81}$, *Ans.*
3. $\frac{3}{8} = \frac{3}{8} \div \frac{5}{6} = \frac{3}{8} \times \frac{6}{5} = \frac{9}{10}$, *Ans.*
4. $\frac{3\frac{1}{2}}{6} = 3\frac{1}{2} \div 6 = \frac{7}{2} \times \frac{1}{6} = \frac{7}{12}$, *Ans.*
5. $\frac{\frac{23}{9}}{\frac{13}{9}} = \frac{23}{9} \div \frac{13}{9} = \frac{23}{9} \times \frac{9}{13} = \frac{23}{13} = 1\frac{5}{13}$, *Ans.*
6. $\frac{4}{6\frac{2}{7}} = 4 \div 6\frac{2}{7} = 4 \times \frac{7}{44} = \frac{7}{11}$, *Ans.*
7. $\frac{\frac{1}{3}}{4\frac{2}{3}} = \frac{1}{3} \div 4\frac{2}{3} = \frac{1}{3} \times \frac{3}{14} = \frac{1}{14}$, *Ans.*
8. $\frac{5\frac{1}{2}}{\frac{2}{3}} = 5\frac{1}{2} \div \frac{2}{3} = \frac{11}{2} \times \frac{3}{2} = \frac{33}{2} = 16\frac{1}{2}$, *Ans.*
9. $\frac{6\frac{1}{2}}{5\frac{1}{3}} = 6\frac{1}{2} \div 5\frac{1}{3} = \frac{13}{2} \times \frac{3}{16} = \frac{39}{32} = 1\frac{7}{32}$, *Ans.*

10. $\frac{5\frac{1}{2}}{6\frac{1}{4}} = 5\frac{1}{2} \div 6\frac{1}{4} = \frac{11}{2} \times \frac{4}{25} = \frac{22}{25}$, *Ans.*
11. $\frac{\frac{2}{3}}{\frac{1}{19}} = \frac{2}{3} \div \frac{1}{19} = \frac{2}{3} \times \frac{19}{1} = \frac{38}{3} = 12\frac{2}{3}$, *Ans.*
12. $\frac{\frac{2}{3}}{\frac{1}{12}} = \frac{2}{3} \div \frac{1}{12} = \frac{2}{3} \times \frac{12}{1} = 8$, *Ans.*
13. $\frac{5\frac{1}{2}}{\frac{1}{17}} = 5\frac{1}{2} \div \frac{1}{17} = \frac{11}{2} \times \frac{17}{1} = \frac{187}{2} = 93\frac{1}{2}$, *Ans.*
14. $\frac{\frac{2}{3} \text{ of } \frac{5}{6}}{\frac{2}{3} \text{ of } 9} = \frac{2}{3} \text{ of } \frac{5}{6} \text{ divided by } \frac{2}{3} \text{ of } 9 = \frac{2}{3} \times \frac{5}{6} \times \frac{3}{2} \times \frac{1}{9} = \frac{5}{54}$.
15. $\frac{\frac{2}{3} \text{ of } 3}{6} = \frac{2}{3} \text{ of } 3 \text{ divided by } 6 = \frac{2}{3} \times \frac{3}{1} \times \frac{1}{6} = \frac{1}{3}$, *Ans.*
16. $\frac{3}{\frac{1}{3} \text{ of } \frac{7}{8}} = 3 \text{ divided by } \frac{1}{3} \text{ of } \frac{7}{8} = \frac{3}{1} \times \frac{3}{1} \times \frac{8}{7} = 6\frac{6}{7}$, *Ans.*
17. $\frac{\frac{2}{3} \text{ of } \frac{5}{6}}{\frac{4}{13} \times 3} = \frac{2}{3} \text{ of } \frac{5}{6} \text{ divided by } \frac{4}{13} \times 3 = \frac{2}{3} \times \frac{5}{6} \times \frac{13}{4} \times \frac{1}{3} = \frac{13}{36}$.

FRACTIONAL RELATION OF NUMBERS.

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29. $\frac{1}{3}$ is $\frac{1}{2}$ of $\frac{2}{3}$, and 1 is 5 times $\frac{1}{2}$ of $\frac{2}{3}$ or $\frac{5}{2}$ of $\frac{2}{3}$; and since 1 is $\frac{5}{2}$ of $\frac{2}{3}$, $\frac{2}{3}$ of 1 is $\frac{2}{3}$ of $\frac{5}{2}$ of $\frac{2}{3}$ or $\frac{5}{3}$ of $\frac{2}{3}$. Therefore, $\frac{2}{3}$ is $\frac{5}{3}$ of $\frac{2}{3}$.
30. $\frac{1}{3}$ is $\frac{1}{2}$ of $\frac{2}{3}$, and 1 is 8 times $\frac{1}{2}$ of $\frac{2}{3}$ or $\frac{8}{2}$ of $\frac{2}{3}$; and since 1 is $\frac{8}{2}$ of $\frac{2}{3}$, $\frac{2}{3}$ is $\frac{8}{2}$ of $\frac{1}{2}$ of $\frac{2}{3}$ or $\frac{4}{1}$ of $\frac{2}{3}$. Therefore, $\frac{2}{3}$ is $\frac{4}{1}$ of $\frac{2}{3}$.

31. $\frac{1}{7}$ is $\frac{1}{4}$ of $\frac{4}{7}$, and 1 is 7 times $\frac{1}{4}$ of $\frac{4}{7}$, or $\frac{7}{4}$ of $\frac{4}{7}$; and since 1 is $\frac{7}{4}$ of $\frac{4}{7}$, $\frac{3}{11}$ of 1 is $\frac{3}{11}$ of $\frac{7}{4}$ of $\frac{4}{7}$, or $\frac{21}{44}$ of $\frac{4}{7}$. Therefore, $\frac{3}{11}$ is $\frac{21}{44}$ of $\frac{4}{7}$.
32. $\frac{1}{11}$ is $\frac{1}{6}$ of $\frac{6}{11}$, and 1 is 11 times $\frac{1}{6}$ of $\frac{6}{11}$, or $\frac{11}{6}$ of $\frac{6}{11}$; and since 1 is $\frac{11}{6}$ of $\frac{6}{11}$, $\frac{5}{7}$ of 1 is $\frac{5}{7}$ of $\frac{11}{6}$ of $\frac{6}{11}$, or $\frac{55}{42}$ of $\frac{6}{11}$. Therefore, $\frac{5}{7}$ is $\frac{55}{42}$ of $\frac{6}{11}$.
33. $\frac{1}{3}$ is $\frac{1}{2}$ of $\frac{2}{3}$, and 1 is 3 times $\frac{1}{2}$ of $\frac{2}{3}$, or $\frac{3}{2}$ of $\frac{2}{3}$; and since 1 is $\frac{3}{2}$ of $\frac{2}{3}$, $\frac{5}{8}$ of 1 is $\frac{5}{8}$ of $\frac{3}{2}$ of $\frac{2}{3}$, or $\frac{15}{8}$ of $\frac{2}{3}$. Therefore, $\frac{5}{8}$ is $\frac{15}{8}$ of $\frac{2}{3}$.
34. $\frac{1}{5}$ is $\frac{1}{3}$ of $\frac{3}{5}$, and 1 is 5 times $\frac{1}{3}$ of $\frac{3}{5}$, or $\frac{5}{3}$ of $\frac{3}{5}$; and since 1 is $\frac{5}{3}$ of $\frac{3}{5}$, $\frac{3}{2}$ of 1 is $\frac{3}{2}$ of $\frac{5}{3}$ of $\frac{3}{5}$, or $\frac{5}{2}$ of $\frac{3}{5}$. Therefore, $\frac{3}{2}$ is $\frac{5}{2}$ of $\frac{3}{5}$.
35. $\frac{1}{7}$ is $\frac{1}{6}$ of $\frac{6}{7}$, and 1 is 7 times $\frac{1}{6}$ of $\frac{6}{7}$, or $\frac{7}{6}$ of $\frac{6}{7}$; and since 1 is $\frac{7}{6}$ of $\frac{6}{7}$, $\frac{3}{8}$ of 1 is $\frac{3}{8}$ of $\frac{7}{6}$ of $\frac{6}{7}$, or $\frac{7}{8}$ of $\frac{6}{7}$. Therefore, $\frac{3}{8}$ is $\frac{7}{8}$ of $\frac{6}{7}$.
36. $\frac{1}{5}$ is $\frac{1}{4}$ of $\frac{4}{5}$, and 1 is 5 times $\frac{1}{4}$ of $\frac{4}{5}$, or $\frac{5}{4}$ of $\frac{4}{5}$; and since 1 is $\frac{5}{4}$ of $\frac{4}{5}$, $\frac{3}{7}$ of 1 is $\frac{3}{7}$ of $\frac{5}{4}$ of $\frac{4}{5}$, or $\frac{15}{14}$ of $\frac{4}{5}$. Therefore, $\frac{3}{7}$ is $\frac{15}{14}$ of $\frac{4}{5}$.
37. $\frac{1}{3}$ is $\frac{1}{5}$ of $\frac{5}{3}$, and 1 is 9 times $\frac{1}{5}$ of $\frac{5}{3}$, or $\frac{9}{5}$ of $\frac{5}{3}$; and since 1 is $\frac{9}{5}$ of $\frac{5}{3}$, $\frac{3}{10}$ of 1 is $\frac{3}{10}$ of $\frac{9}{5}$ of $\frac{5}{3}$, or $\frac{27}{10}$ of $\frac{5}{3}$. Therefore, $\frac{3}{10}$ is $\frac{27}{10}$ of $\frac{5}{3}$.

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13. Since $\frac{1}{7}$ is $\frac{1}{5}$ of some number, $\frac{1}{5}$ of the number is $\frac{1}{4}$ of $\frac{4}{5}$, or $\frac{2}{5}$; and since $\frac{1}{5}$ of the number is $\frac{2}{5}$, the number is 5 times $\frac{2}{5}$, or $\frac{2}{1}$. Hence, $\frac{1}{7}$ is $\frac{1}{5}$ of $\frac{2}{1}$.—Since $\frac{3}{8}$ is $\frac{1}{11}$ of some number, $\frac{1}{11}$ of the number is $\frac{1}{7}$ of $\frac{7}{8}$, or $\frac{1}{8}$; and since $\frac{1}{11}$ of the number is $\frac{1}{8}$, the number is 11 times $\frac{1}{8}$ or $\frac{11}{8}$. Hence, $\frac{3}{8}$ is $\frac{11}{8}$ of $\frac{1}{8}$.

14. Since $\frac{1}{3}$ is $\frac{2}{3}$ of some number, $\frac{1}{3}$ of the number is $\frac{1}{3}$ of $\frac{1}{3}$, or $\frac{1}{9}$; and since $\frac{1}{3}$ of the number is $\frac{2}{3}$, the number is 7 times $\frac{2}{3}$, or $\frac{14}{3}$, or $\frac{2}{3}$. Hence, $\frac{1}{3}$ is $\frac{2}{3}$ of $\frac{2}{3}$.—Since $\frac{2}{3}$ is $\frac{1}{2}$ of some number, $\frac{1}{3}$ of the number is $\frac{1}{2}$ of $\frac{2}{3}$, or $\frac{1}{3}$; and since $\frac{1}{3}$ of the number is $\frac{2}{3}$, the number is 7 times $\frac{1}{3}$, or $\frac{7}{3}$. Hence, $\frac{2}{3}$ is $\frac{1}{2}$ of $\frac{7}{3}$.
15. Since $\frac{4}{5}$ is $\frac{7}{8}$ of some number, $\frac{1}{5}$ of the number is $\frac{1}{8}$ of $\frac{4}{5}$, or $\frac{1}{10}$; and since $\frac{1}{5}$ of the number is $\frac{7}{8}$, the number is 13 times $\frac{7}{8}$, or $\frac{91}{8}$, or $\frac{7}{8}$. Hence, $\frac{4}{5}$ is $\frac{7}{8}$ of $\frac{7}{8}$.—Since $\frac{3}{5}$ is $\frac{2}{3}$ of some number, $\frac{1}{5}$ of the number is $\frac{1}{3}$ of $\frac{3}{5}$, or $\frac{1}{5}$; and since $\frac{1}{5}$ of the number is $\frac{2}{3}$, the number is 7 times $\frac{1}{3}$, or $\frac{7}{3}$, or 1. Hence, $\frac{3}{5}$ is $\frac{2}{3}$ of 1.
16. Since $\frac{1}{2}$ is $\frac{2}{3}$ of some number, $\frac{1}{3}$ of the number is $\frac{1}{3}$ of $\frac{1}{2}$, or $\frac{1}{6}$; and since $\frac{1}{3}$ of the number is $\frac{2}{3}$, the number is 15 times $\frac{2}{3}$, or $\frac{10}{3}$. Hence, $\frac{1}{2}$ is $\frac{2}{3}$ of $\frac{10}{3}$.—Since $\frac{4}{5}$ is $\frac{1}{10}$ of some number, $\frac{1}{10}$ of the number is $\frac{1}{10}$ of $\frac{4}{5}$, or $\frac{2}{25}$; and since $\frac{1}{10}$ of the number is $\frac{7}{10}$, the number is 10 times $\frac{7}{10}$, or $\frac{70}{10}$, or $\frac{7}{10}$. Hence, $\frac{4}{5}$ is $\frac{7}{10}$ of $\frac{7}{10}$.

REVIEW EXERCISES.

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- $\$7\frac{3}{4} + \$5\frac{1}{4} = \$13\frac{1}{2}$, value of purchases;
 $\$20 - \$13\frac{1}{2} = \$6\frac{1}{2}$, the change he should receive.
- $\$.11\frac{1}{2} \times 360 = \40.05 , cost of sugar;
 $\$.62\frac{1}{2} \times 50 = 31.25$, cost of tea;
 $\$71.30$, cost of both, *Ans.*

3. Since he can cut $\frac{1}{2}$ of 7 acres, or $3\frac{1}{2}$ acres, in 1 day, in $\frac{5}{7}$ of a day he can cut $\frac{5}{7}$ of $3\frac{1}{2}$ acres, or $2\frac{1}{2}$ acres, *Ans.*

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4. They will cost $3\frac{5}{12}$ times \$.18 $\frac{3}{4}$, which is \$.64 $\frac{1}{16}$, *Ans.*
5. If a man can hoe a field in $7\frac{1}{4}$ days, he could hoe one $2\frac{2}{3}$ times as large, in $2\frac{2}{3}$ times $7\frac{1}{4}$ days, or $\frac{58}{3}$ days; and 3 men can do it in $\frac{1}{3}$ of the time required for 1 man to do it, or in $\frac{1}{3}$ of $\frac{58}{3}$ days, or $\frac{58}{9} = 6\frac{4}{9}$ days, *Ans.*
6. Since $\frac{1}{7}$ of the quantity leaked out, there was left but $\frac{6}{7}$ of $41\frac{1}{2}$ gallons, or $35\frac{1}{4}$ gallons; and since he wishes to obtain \$6.15 for $35\frac{1}{4}$ gallons, the price of 1 gallon is found by dividing \$6.15 by $35\frac{1}{4}$, which gives $17\frac{3}{4}$ cents.
7. Mr. Banker bought $\frac{2}{3}$ of $\frac{3}{4}$ of 155 A., which is $37\frac{1}{2}$ A.
8. The entire cost of the block was the sum of \$3122 $\frac{1}{4}$, \$1368 $\frac{1}{2}$, \$3258 $\frac{3}{4}$ and $1325\frac{5}{12}$, which is \$9074 $\frac{31}{60}$; and $10000 - 9074\frac{31}{60} = 925\frac{74}{60}$, the gain, *Ans.*
9. $\frac{2}{3}$ of $272\frac{1}{4}$ sq. ft., or $163\frac{7}{6}$ sq. ft., *Ans.*
10. Since \$3215 is $1\frac{5}{9}$, or $\frac{14}{9}$, of the cost, $\frac{1}{9}$ of the cost is $\frac{1}{14}$ of \$3215, which is $321\frac{5}{14}$; and since $\frac{1}{9}$ of the cost is $321\frac{5}{14}$, the cost will be 9 times $321\frac{5}{14}$, or $2892\frac{45}{14}$, or $2066\frac{11}{14}$.
11. They will earn $8 \times 6\frac{2}{3} \times \$2\frac{7}{8}$, or \$153 $\frac{1}{3}$, *Ans.*
12. He will walk $30\frac{1}{2}$ miles in as many hours as $3\frac{1}{4}$ is contained times in $30\frac{1}{2}$, which is $9\frac{5}{8}$ hours, *Ans.*
13. $\frac{3}{5}$ of \$19000 = \$11400, am't divided among 4 sons;
 $\$11400 \div 4 = \2850 , the share of each son;
 $\frac{2}{3}$ of \$19000 = \$7600, am't divided among 3 daughters;
 $\$7600 \div 3 = \$2533\frac{1}{3}$, the share of each daughter, *Ans.*

14. $\$.20 \times 3140 = \628 , the amount received this year. Since $\$628$ is $\frac{7}{8}$ of what would have been received for it last year, $\frac{1}{8}$ of what would have been received for it last year is $\frac{1}{7}$ of $\$628$, which is $\$90\frac{2}{7}$; and the whole amount received last year would have been 8 times $\$90\frac{2}{7}$, or $\$717\frac{2}{7}$. $\$717\frac{2}{7} - \$628 = \$89\frac{2}{7}$ more than this year, *Ans.*
15. Since $\frac{1}{8}$ of the quantity is taken for grinding, he brings back but $\frac{7}{8}$ of the amount taken to the mill. Therefore, 14 bu. = $\frac{7}{8}$ of amount taken to mill; 2 bu. = $\frac{1}{8}$ of the amount taken to mill; 16 bu. = whole amount taken to mill, *Ans.*
16. Since $\$45 = \frac{5}{7}$ of my money, $\$9 = \frac{1}{7}$ of my money; $\$63 =$ whole of my money; $\$45 + \$18 = \$63$; and $\frac{49\frac{1}{2}}{63} = \frac{99}{126} = \frac{11}{14}$, the part that $\$49\frac{1}{2}$ is of my money.
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17. Since he kept $\frac{1}{3}$ of his sheep in one field, and the rest in another, the other field must have had $\frac{2}{3}$ of his sheep. Therefore, $\frac{2}{3}$ of his sheep = 148 sheep; $\frac{1}{3}$ of his sheep = 74 sheep; the entire number of his sheep = 222 sheep.
18. $\$7\frac{2}{3} \times 21 = \$159\frac{2}{3}$, the value of flour; $\$159\frac{2}{3} \div 24\frac{2}{3} = \$6\frac{1}{2}\frac{2}{3}$, cost of wood per cord, *Ans.*
19. Since he gave the sum of $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{6}$, or $\frac{9}{12}$, he had $\frac{3}{12}$ or $\frac{1}{4}$ left, *Ans.*
20. Since A sells $\frac{2}{3}$ of his share, he will have $\frac{1}{3}$ left; and since he owned $\frac{5}{7}$ of the vessel, he will have $\frac{1}{3}$ of $\frac{5}{7}$, or $\frac{5}{21}$ of the vessel left; B will have $\frac{2}{3}$ of $\frac{5}{7}$, or $\frac{10}{21}$ of the ves-

- sel. The value of A's share is $\frac{5}{21}$ of \$18326, or \$4363 $\frac{1}{2}$; the value of B's share is $\frac{1}{21}$ of \$18326, or \$8726 $\frac{2}{3}$, *Ans.*
21. Since I had $\frac{3}{4}$ of my money left after buying my clothes, my clothes must have cost $\frac{1}{4}$ of my money. Therefore, $\frac{3}{4}$ of my money = \$60; $\frac{1}{4}$ of my money = \$15; entire amount = \$105, *Ans.*
22. $\frac{5}{7}$ of $8\frac{1}{2} \div \frac{1}{2}$ of $3\frac{1}{2} = \frac{5}{7} \times 4\frac{1}{2} \times \frac{2}{1} \times \frac{1}{16} = \frac{205}{16} = 3\frac{37}{16}$.
23. If 9 horses eat $16\frac{1}{2}$ tons, 1 horse will eat $\frac{1}{9}$ of $16\frac{1}{2}$ tons, which is $1\frac{2}{3}$ tons; and 7 horses will eat 7 times $1\frac{2}{3}$ tons, or $12\frac{2}{3}$ tons, *Ans.*
24. If $\frac{3}{4}$ of a farm is worth \$8516, $\frac{1}{4}$ of a farm is worth \$2838 $\frac{2}{3}$; the whole farm is worth \$11354 $\frac{2}{3}$, *Ans.*
25. Since he spent $\frac{1}{3}$ of his income traveling, and $\frac{1}{5}$ of $\frac{2}{3}$, or $\frac{2}{15}$, of his income for books, he spent for both, $\frac{1}{3} + \frac{2}{15}$ or $\frac{7}{15}$ of his income. Since he spent the rest of his money, which was $\frac{8}{15}$ of his income, for paintings and other works of art, $\frac{8}{15}$ of his income is \$8526; $\frac{1}{15}$ of his income is \$1065 $\frac{3}{4}$; his entire income is \$15986 $\frac{1}{4}$.
26. $14\frac{1}{2} \div 3\frac{1}{2} = 4\frac{1}{2}$, number of days the second worked;
 $3\frac{1}{2} + 4\frac{1}{2} = 7\frac{1}{2}$, number of days both worked;
 $\frac{3\frac{1}{2}}{7\frac{1}{2}} = \frac{49}{107}$, the part of the money the first earned;
 $\frac{4\frac{1}{2}}{7\frac{1}{2}} = \frac{58}{107}$, the part of the money the second earned;
 $\frac{49}{107}$ of \$53 = \$24 $\frac{29}{107}$, the share of the first, *Ans.*
 $\frac{58}{107}$ of \$53 = \$28 $\frac{78}{107}$, the share of the second, *Ans.*
27. $\frac{1}{2}$ of \$13000 = \$6500, the value of the brothers' shares. Since one owns $\frac{2}{3}$ as much as the other, the share of the larger owner + $\frac{2}{3}$ of that amount, or $\frac{5}{3}$ of the share

of the larger owner, is equal to the shares of both. Therefore, $\frac{2}{3}$ of the share of the larger owner = \$6500; $\frac{1}{3}$ of the share of the larger owner = \$1300; entire share of the larger owner = \$3900, *Ans.* $\frac{2}{3}$ of \$3900 = \$2600, the other's share, *Ans.*

28. $\frac{2}{3}$ value of stock = \$3865; $\frac{1}{3}$ value of stock = \$1932 $\frac{1}{2}$; entire value of stock = \$5797 $\frac{1}{2}$, *Ans.*

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30. Since A can do it in 5 days, he can do $\frac{1}{5}$ of the work per day. Since B can do it in 8 days, he can do $\frac{1}{8}$ of the work per day. Both working together can do $\frac{1}{5} + \frac{1}{8}$, or $\frac{13}{40}$, of the work per day; and since if they could do but $\frac{1}{40}$ per day, it would require 40 days, when they do $\frac{13}{40}$ it will require but $\frac{1}{13}$ of 40 days, or $3\frac{1}{13}$ days, *Ans.*
31. Since A and B can do $\frac{1}{10}$ of the work per day, and A can do $\frac{1}{15}$ of the work per day, $\frac{1}{10} - \frac{1}{15} = \frac{1}{30}$, the part B can do per day; and since he can do $\frac{1}{30}$ of the work per day, it will require 30 days to do the work, *Ans.*
32. Since $\frac{3}{5}$ of shorter piece = $\frac{2}{3}$ of longer, $\frac{1}{5}$ of shorter piece = $\frac{2}{31}$ of longer, and the shorter piece = $\frac{2}{31}$ of longer. Therefore, the longer piece + $\frac{2}{31}$ of the longer piece, or $\frac{33}{31}$ of the longer piece, is the whole length. Therefore, $\frac{33}{31}$ of the longer piece = 124 ft.; $\frac{2}{31}$ of the longer piece = 4 ft.; the longer piece = 84 ft.; 124 ft. - 84 ft. = 40 ft., the shorter piece, *Ans.*
33. Since after spending $\frac{1}{2}$ his money and \$ $\frac{1}{2}$, he had \$21 left, before he spent the \$ $\frac{1}{2}$ he had $\frac{1}{2}$ of his money left. Therefore, \$21 $\frac{1}{2}$ = $\frac{1}{2}$ of his money, and \$43 = the whole of his money, *Ans.*

34. Since A can do $\frac{1}{25}$ of the work in 1 day, and B can do $\frac{1}{30}$ in 1 day, both can do $\frac{1}{25} + \frac{1}{30}$, or $\frac{11}{150}$, in 1 day. Since A, B, and C can do $\frac{1}{5}$ per day, $\frac{1}{5} - \frac{11}{150}$ will leave the part of the work C can do in 1 day. $\frac{1}{5} - \frac{11}{150} = \frac{17}{150}$, the part C can do in 1 day. If he could do $\frac{1}{150}$ per day, it would take him 450 days; but since he can do $\frac{17}{150}$, it will take him $\frac{1}{17}$ of 450 days, or $26\frac{2}{17}$ days, *Ans.*
35. Since the shorter ladder is $\frac{2}{3}$ of the longer one, the longer ladder $+ \frac{2}{3}$ of the longer ladder, or $\frac{5}{3}$ of the longer ladder is the length of both ladders. Therefore, $\frac{5}{3}$ of the longer ladder = 75 ft.; $\frac{1}{3}$ of the longer ladder = 15 ft.; the longer ladder = 45 ft.; the shorter ladder = 75 ft. — 45 ft., or 30 ft., *Ans.*
36. Since the less number is $\frac{3}{4}$ of the greater, the greater $+ \frac{3}{4}$ of the greater, or $\frac{7}{4}$ of the greater, is the sum of the numbers. Therefore, $\frac{7}{4}$ of the greater = 140; $\frac{1}{4}$ of the greater = 20; the greater = 80; the less = 140 — 80 = 60, *Ans.*
37. His profits were decreased $\frac{1}{5}$ of \$2756 $\frac{1}{2}$, or \$551 $\frac{3}{10}$, which sum was $\frac{1}{3}$ of his profits in 1875; therefore his profits in 1875 were 3 times \$551 $\frac{3}{10}$ or \$1653 $\frac{9}{10}$. His profits at that time were $\frac{1}{5}$ of his receipts; therefore, \$1653 $\frac{9}{10}$ is $\frac{1}{5}$ of his receipts, which are 5 times \$1653 $\frac{9}{10}$, or \$8269 $\frac{1}{2}$.
38. Since $\frac{2}{3}$ of A's money = $\frac{3}{5}$ of B's, $\frac{1}{3}$ of A's money = $\frac{3}{10}$ of B's, and A's money = $\frac{9}{10}$ of B's; and since the sum of A's and B's money is equal to \$5700, $\frac{9}{10}$ of B's money + B's money, or $\frac{19}{10}$ of B's money = \$5700; $\frac{1}{10}$ of B's money = \$300; B's money = \$3000; A's money = \$5700 — \$3000 = \$2700, *Ans.*

39. After working 9 months he would have been entitled to $\frac{3}{4}$ of \$240 and $\frac{3}{4}$ of a suit of clothes, or $\$180 + \frac{3}{4}$ suit of clothes. He received $\$168 +$ a suit of clothes in equitable settlement; therefore, $\frac{1}{4}$ of the value of the suit of clothes must have been \$12, and the whole value of it, 4 times \$12, or \$48, *Ans.*
40. A and B can do $\frac{1}{12}$ of the work per day; and since A can do $\frac{3}{4}$ as much as B, when both work together, A does 3 parts while B does 4 parts, or A does $\frac{3}{7}$ and B $\frac{4}{7}$ of the work. $\frac{3}{7}$ of $\frac{1}{12}$, or $\frac{1}{28}$, is the part A does per day, and therefore it will take him 28 days to do the work; $\frac{4}{7}$ of $\frac{1}{12}$ or $\frac{1}{21}$ is the part B does per day, and therefore it will take him 21 days, *Ans.*

REDUCTION OF DECIMALS.

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19. $.12\frac{1}{2} = \frac{12\frac{1}{2}}{100} = \frac{\frac{25}{2}}{100} = \frac{25}{200} = \frac{1}{8}, \text{ Ans.}$
20. $.33\frac{1}{3} = \frac{33\frac{1}{3}}{100} = \frac{\frac{100}{3}}{100} = \frac{100}{300} = \frac{1}{3}, \text{ Ans.}$
21. $.16\frac{2}{3} = \frac{16\frac{2}{3}}{100} = \frac{\frac{50}{3}}{100} = \frac{50}{300} = \frac{1}{6}, \text{ Ans.}$
22. $.87\frac{1}{2} = \frac{87\frac{1}{2}}{100} = \frac{\frac{175}{2}}{100} = \frac{175}{200} = \frac{7}{8}, \text{ Ans.}$
23. $.04\frac{2}{5} = \frac{4\frac{2}{5}}{100} = \frac{\frac{22}{5}}{100} = \frac{22}{500} = \frac{11}{250}, \text{ Ans.}$

$$24. .037\frac{1}{2} = \frac{37\frac{1}{2}}{1000} = \frac{\frac{75}{2}}{1000} = \frac{75}{2000} = \frac{3}{80}, \text{ Ans.}$$

$$25. .562\frac{1}{2} = \frac{562\frac{1}{2}}{1000} = \frac{\frac{1125}{2}}{1000} = \frac{1125}{2000} = \frac{9}{16}, \text{ Ans.}$$

$$26. .003\frac{3}{4} = \frac{3\frac{3}{4}}{1000} = \frac{\frac{15}{4}}{1000} = \frac{15}{4000} = \frac{3}{800}, \text{ Ans.}$$

$$27. .078\frac{3}{10} = .0783 = \frac{783}{10000}, \text{ Ans.}$$

$$28. .0003\frac{1}{2} = \frac{3\frac{1}{2}}{10000} = \frac{\frac{7}{2}}{10000} = \frac{7}{20000}, \text{ Ans.}$$

$$29. .756\frac{1}{5} = \frac{756\frac{1}{5}}{1000} = \frac{\frac{3781}{5}}{1000} = \frac{3781}{5000}. \text{ Therefore, } 2.756\frac{1}{5} = 2\frac{3781}{5000}, \text{ Ans.}$$

$$30. .81\frac{4}{5} = \frac{81\frac{4}{5}}{100} = \frac{\frac{409}{5}}{100} = \frac{409}{500}. \text{ Therefore, } 13.81\frac{4}{5} = 13\frac{409}{500}.$$

ADDITION OF DECIMALS.

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11. $6\frac{1}{4}$ expressed as a decimal = 6.25;

$3\frac{2}{5}$ expressed as a decimal = 3.4;

$5\frac{3}{8}$ expressed as a decimal = 5.375;

$6\frac{1}{5}$ expressed as a decimal = 6.2;

$9\frac{3}{4}$ expressed as a decimal = 9.75;

30.975, Ans.

12. He earned the sum of the amounts given:

\$7.25

$$\$7.12\frac{1}{2} = \$7.125$$

$$\$9.18\frac{3}{4} = \$9.1875$$

$$\$8\frac{5}{8} = \$8.625$$

\$32.1875, or \$32.18 $\frac{3}{4}$, *Ans.*

13. $\frac{18}{1000}$ expressed as a decimal = .018;

$$\frac{15}{1000000} \text{ expressed as a decimal} = .000015;$$

$$\frac{81}{100} \text{ expressed as a decimal} = .81;$$

$$\frac{146}{10000} \text{ expressed as a decimal} = .0146;$$

$$\frac{834}{100000} \text{ expressed as a decimal} = .00834;$$

.850955, *Ans.*

14. 8 dollars 5 cents = \$ 8.05;

$$13 \text{ dollars } 19 \text{ cents} = \$13.19;$$

$$18 \text{ dollars } 3 \text{ cents } 8 \text{ mills} = \$18.038;$$

$$25 \text{ dollars } 37 \text{ cents } 5 \text{ mills} = \$25.375;$$

$$\$12\frac{5}{8} = \$12.625;$$

$$\$7\frac{7}{16} = \$7.4375$$

\$77.7155, *Ans.*

15. He paid for repairs, the sum of the following:

\$381.45

215.385

323.94

181.57

\$1102.345, *Ans.*

16. He paid for all, the sum of the following:

$$\begin{array}{r}
 \$13\frac{7}{8} = \$13.875 \\
 8\frac{5}{16} = 8.3125 \\
 \$10\frac{1}{8} = 10.6875 \\
 \underline{15.49} \\
 \$48.365, \text{ Ans.}
 \end{array}$$

SUBTRACTION OF DECIMALS.

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9. From .000084

$$\begin{array}{r}
 \text{Take } .000084 \\
 \hline
 .0000756, \text{ Ans.}
 \end{array}$$

10. From 80000.

$$\begin{array}{r}
 \text{Take } .080 \\
 \hline
 79999.92, \text{ Ans.}
 \end{array}$$

11. From \$29.03

$$\begin{array}{r}
 \text{Take } 17.09 \\
 \hline
 \$11.94, \text{ Ans.}
 \end{array}$$

12. From \$27.08

$$\begin{array}{r}
 \text{Take } 9.375 \\
 \hline
 \$17.705, \text{ Ans.}
 \end{array}$$

13. \$50.

$$\begin{array}{r}
 45.895 \\
 \hline
 \$4.105, \text{ the amount left, Ans.}
 \end{array}$$

14. \$12384.16

$$\begin{array}{r}
 9864.18 \\
 \hline
 $2519.98, \text{ part of income left, Ans.}
 \end{array}$$

15. \$1,374,837.64

$$\begin{array}{r}
 1,298,369.58 \\
 \hline
 \$76,468.06, \text{ the surplus, Ans.}
 \end{array}$$

MULTIPLICATION OF DECIMALS.**Page 142.**

$$25. \frac{3}{4} \text{ of } .55 \times \frac{2}{3} \text{ of } 6.5 = .75 \text{ of } .55 \times .4 \text{ of } 6.5 = .75 \times .55 \times .4 \times 6.5 = 1.0725, \text{ Ans.}$$

$$36. \$.13\frac{1}{2} \times 37 = \$ 4.995$$

$$\$.37\frac{1}{2} \times 8 = \$ 3.$$

$$\$2.35 \times 27 = \$63.45$$

\$71.445, cost of purchases, *Ans.*

SHORT PROCESSES.**Page 149.**

3. Since $12\frac{1}{2}$ is $\frac{1}{8}$ of 100, we first multiply by 100, and divide the result by 8.

$$8 \overline{) 68800}$$

8600, *Ans.*

4. $16\frac{2}{3} = \frac{1}{6}$ of 100. Therefore, $402 \times 16\frac{2}{3} = \frac{40200}{6} = 6700$, *Ans.*

5. $25 = \frac{1}{4}$ of 100. Therefore, $5056 \times 25 = \frac{505600}{4} = 126400$, *Ans.*

6. $33\frac{1}{3} = \frac{1}{3}$ of 100. Therefore, $75630 \times 33\frac{1}{3} = \frac{7563000}{3} = 2521000$, *Ans.*

7. $50 = \frac{1}{2}$ of 100. Therefore, $8404 \times 50 = \frac{840400}{2} = 420200$, *Ans.*

8. $37\frac{1}{2} = \frac{3}{8}$ of 100. Therefore, $2160 \times 37\frac{1}{2} = \frac{3}{8}$ of 216000
 $= 81000$, *Ans.*
9. $66\frac{2}{3} = \frac{2}{3}$ of 100. Therefore, $4236 \times 66\frac{2}{3} = \frac{2}{3}$ of 423600
 $= 282400$, *Ans.*
10. $75 = \frac{3}{4}$ of 100. Therefore, $7288 \times 75 = \frac{3}{4}$ of 728800
 $= 546600$, *Ans.*
11. $\$1 \times 27 = \$27 = \$6.75$, *Ans.*
12. $\$.33\frac{1}{3} = \frac{1}{3}$ of \$1. Therefore, $\$.33\frac{1}{3} \times 824 = \frac{1}{3} \times 824$
 $= \$274.66\frac{2}{3}$, *Ans.*
13. $\$.75 = \frac{3}{4}$ of \$1. Therefore, $\$.75 \times 216 = \frac{3}{4} \times 216$
 $= \$162$, *Ans.*
14. $\$.37\frac{1}{2} = \frac{3}{8}$ of \$1. Therefore, $\$.37\frac{1}{2} \times 287 = \frac{3}{8} \times 287$
 $= \$107.625$, *Ans.*
15. $\$.62\frac{1}{2} = \frac{5}{8}$ of \$1. Therefore, $\$.62\frac{1}{2} \times 394 = \frac{5}{8} \times 394$
 $= \$246.25$, *Ans.*
- 16 Since $\$.37\frac{1}{2} = \frac{3}{8}$ of \$1, $\$1.37\frac{1}{2} = \$1\frac{3}{8}$. Therefore,
- $$\$1\frac{3}{8} \times 319 = \begin{cases} \$1 \times 319 = \$319. \\ \$\frac{1}{4} \times 319 = \$79.75 \\ \$\frac{3}{8} \times 319 = \$39.875 \\ \hline \$1\frac{3}{8} \times 319 = \$438.625, \text{ } \textit{Ans.} \end{cases}$$

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2. 6075 pounds = 60.75 hundred-weight; and $\$.35 \times 60.75 = \$21.26\frac{1}{4}$, *Ans.*
3. 8609 shingles = 8.609 thousand shingles; and $\$4.75 \times 8.609 = \40.89275 , *Ans.*

4. 1925 pounds = 1.925 thousand pounds; and since the hay costs \$9.50 for 2000 pounds, it will cost \$4.75 for 1000 pounds. Therefore, $\$4.75 \times 1.925 = \9.14375 , the cost, *Ans.*
5. 16795 pounds = 167.95 hundred-weight; and $\$4.50 \times 167.95 = \$755.77\frac{1}{2}$, *Ans.*
6. 129765 laths = 129.765 thousand; and $\$2.75 \times 129.765 = \$356.853 +$, *Ans.*
7. 6975 bricks = 6.975 thousand; and $\$3.25 \times 6.975 = \$22.668 +$, *Ans.*
8. 1825 pounds = 1.825 thousand pounds; and since the iron costs \$45 per ton, it will cost $\frac{1}{2}$ of \$45, or \$22.50, per thousand pounds. Therefore, $\$22.50 \times 1.825 = \41.0625 , *Ans.*
9. 6780 envelopes = 6.780 thousand; and $\$2.75 \times 6.780 = \18.645 , *Ans.*
10. 550 pine-apples = 5.50 hundred; and $\$13.25 \times 5.50 = \72.875 , *Ans.*
11. 1592 pounds = 15.92 hundred pounds; and $\$4.50 \times 15.92 = \71.64 , *Ans.*
12. Since the coal costs \$7.50 per ton, it will cost $\frac{1}{2}$ of \$7.50, or \$3.75, per thousand pounds; and $\$3.75 \times 15 = \56.25 , *Ans.*
13. Since the broom-corn costs \$55 per ton, it will cost $\frac{1}{2}$ of \$55, or \$27.50, per thousand pounds; and $\$27.50 \times 2.294 = \63.085 , *Ans.*
14. 1964 pounds = 19.64 hundred-weight; and $\$13.45 \times 19.64 = \264.158 , *Ans.*

ACCOUNTS AND BILLS.**Page 153.**

| | | | |
|-------|--------------------|-------------|------------------------|
| 2. | 75½ yd. carpeting, | @ \$2.12½ = | \$160.437 |
| 37 | “ drugget, | “ 1.20 = | 44.40 |
| 8 | rugs, | “ 4.16 = | 33.28 |
| 5 | mats, | “ 2.37½ = | 11.875 |
| 18 | yd. oil-cloth, | “ 1.08 = | 19.44 |
| 9 | “ carpet lining, | “ .12½ = | 1.125 |
| 3 | carpet-sweepers, | “ 2.00 = | 6.00 |
| 2 | doz. stair-rols, | “ 8.25 = | 16.50 |
| <hr/> | | | |
| | | | \$293.057, <i>Ana.</i> |

| | | | |
|-------|------------------|-------------|------------------------|
| 3. | 37 bbl. pork, | @ \$24.35 = | \$900.95 |
| 127 | “ flour, | “ 8.15 = | 1035.05 |
| 3 | hhd. molasses, | } “ .43 = | 72.67 |
| 169 | gal., | | |
| 29 | firkins butter, | } “ .31 = | 657.20 |
| 2120 | lb., | | |
| 3 | boxes raisins, | “ 4.65 = | 13.95 |
| 5 | bbl. kerosene, | } “ .18¼ = | 37.78 |
| 207 | gal. | | |
| 25 | doz. cans fruit, | “ 2.40 = | 60.00 |
| 3 | pkgs. tobacco, | } “ .45 = | 143.10 |
| 318 | lb., | | |
| 13 | doz. spices, | “ 1.10 = | 14.30 |
| <hr/> | | | |
| | | | \$2935.00, <i>Ana.</i> |

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| | | |
|---------------------------------|---------|----------------------------|
| 4. | — Dr. — | |
| 3 gold watches | | = \$ 242.92 |
| 437 pwt. gold chains, @ \$ 1.15 | | = 502.55 |
| 35 sets tea-service, " 43.10 | | = 1508.50 |
| 7 sets tea-service, " 51. | | = 357.00 |
| 5 silver pie-knives, " 12. | | = 60.00 |
| 12 plated ice-pitchers, " 12.50 | | = 150.00 |
| | | <u>\$2820.97</u> |
| | — Cr. — | 427.37 |
| | | <u>Bal. due, \$2393.60</u> |

5.

CHICAGO, June 3, 1878.

MRS. M. T. DANA,

Bought of G. C. SMITH & Co.:

| | |
|-------------------------------------|----------------|
| 25 yd. calico @ \$.10 | \$2 50 |
| 37 yd. sheeting " .18½ | 6 75 |
| 2 pairs gloves " 1.50 | 3 00 |
| 1 sun-umbrella | 6 75 |
| 5 yd. Hamburg edging . . . @ \$.25 | 1 25 |
| 7 pairs hose " .85 | 5 95 |
| | <u>\$26 20</u> |

Received Payment,

G. C. SMITH & Co.,

Per MARTIN.

6.

OLEAN, N. Y., Jan. 10, 1878.

MR. C. C. LOVELL,

Bought of R. P. LAWTON :

| | | | |
|--------------------------|---------------|-------|----|
| 7568 ft. hemlock . . @ | \$12.75 per M | \$96 | 49 |
| 8539 " pine flooring . " | 23.50 " | 200 | 67 |
| 5608 " clear pine . . " | 45.00 " | 252 | 36 |
| 3815 " oak joists . . " | 32.00 " | 122 | 08 |
| 7346 " ash flooring . " | 34.00 " | 249 | 76 |
| | | \$921 | 36 |

Received Payment by note at 30 days,

R. P. LAWTON.

7.

ROCHESTER, N. Y., May 5, 1878.

MR. GEO. M. LINE,

Bought of STEELE & AVERY :

| | | | |
|----------------------------|------------|-------|----|
| 15 reams comm'l note . @ | \$1.25 | \$18 | 75 |
| 7500 envelopes " | 3.65 per M | 27 | 38 |
| 18 gross steel pens. . . " | .75 | 13 | 50 |
| 24 Ridpath's Histories . " | 1.25 | 30 | 00 |
| 9 Webster's Dictionaries " | 10.25 | 92 | 25 |
| | | \$181 | 88 |

Received Payment,

STEELE & AVERY.

REVIEW EXERCISES.**Page 155.**

1. $\$123.59 \div \$.34 = 363\frac{1}{2}$, the number of pounds, *Ans.*
2. $8.339 \text{ lb.} \times 15\frac{1}{4} = 127.16975 \text{ lb.}$, *Ans.*
3. $272\frac{1}{4} \text{ sq. ft.} \times 7\frac{5}{8} = 2075.90625 \text{ sq. ft.}$, or $2075\frac{29}{32} \text{ sq. ft.}$
4. $2000 \text{ lb.} \div 55.32 = 36.153 +$, the number of cu. ft.
5. $2150.42 \text{ cu. in.} \times 1000 = 2150420 \text{ cu. in.}$, *Ans.*
6. $3 \div .003 = .003) 3.000 (= 1000$, *Ans.*
7. $300 \div .00003000 = .00003) 300.00000 (= 10000000$.
8. $2182565 \text{ ft.} \times .20 = 436513 \text{ ft.}$, the part sold,
 $2182565 \text{ ft.} - 436513 \text{ ft.} = 1746052 \text{ ft.}$, amount left;
 $1746052 \text{ ft.} \times .15 = 261907.8 \text{ ft.}$ burned, *Ans.*
9. $385 \text{ lb.} = 3.85 \text{ cwt.}$; and $\$4.25 \times 3.85 = \$16.36\frac{1}{4}$.
10. $\$31.25 \div \$.11\frac{1}{4} = 277\frac{7}{8}$, the number of pounds, *Ans.*
11. $4.37\frac{1}{2} \times 26 = \113.75 , cost of broadcloth
 $\$113.75 \div \$7.25 = 1568.96 + \text{lb.}$, *Ans.*
12. If 15 tons cost \$125.25, 1 ton will cost $\frac{1}{15}$ of that sum,
which is \$8.35; and 35 tons will cost 35 times \$8.35,
which is = \$292.25, *Ans.*
13. $\$1.25 \times 350 = \437.50 , *Ans.*
14. $\$325 \div \$6.25 = 5200$, the number of pounds, *Ans.*
15. $8000 \div .004 = .004) 8000.000 (= 2000000$, *Ans.*

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16. $.0008 \div 40000 = 40000$).00080000 (= .00000002.
17. $\$4.43\frac{3}{4} \times 8 = \35.50 , the cost of wood;
 $\$35.50 \div \$1.37\frac{1}{2} = 25_{\text{IT}}$, or 25.818 + days, *Ans.*
18. $\$2.75 \times 27 = \74.25 , the cost of silk;
 $6.37\frac{1}{2} \times 11 = 70.125$, the cost of lace;
 $2.15 \times 9 = 19.35$, the cost of the gloves;
 $1.10 \times 10 = 11.00$, the cost of the hose;
 $\$174.725$, the entire cost, *Ans.*
19. $\$12.50 - \$7.625 = \$4.875$, amount saved per week;
 $\$500 \div \$4.875 = 102.56 +$, the number of weeks.
20. 95150 bricks = 95.150 thousand; and $\$7.25 \times 95.150 = \$689.83\frac{1}{2}$, *Ans.*
21. $\$6688.50 \div 91 = \73.50 , price per acre of 91 acres;
 $\$73.50 + \$1.12\frac{1}{2} = \$74.625$, price per acre of the rest;
 $195 - 91 = 104$, number of acres worth $\$74.625$ per acre. Therefore, $\$74.625 \times 104 = \7761 , the value of 104 acres; $\$6688.50 + \$7761 = \$14449.50$, the value of farm, *Ans.*
22. $\$.20 \times 200 = \40 , the loss on sheep;
 $\$4.50 \times 175 = \787.50 , the cost of 175 sheep;
 $\$787.50 + \$40 = \$827.50$, what he sold them for;
 $\$827.50 \div 175 = \4.728 , the price per head, *Ans.*
23. Since .40 of profits were expenses, .40 of .15 of the value of the goods sold, or .06 of their value, was the expenses; .15 of the value of the goods sold minus .06 of their value equals .09 of the value of the goods sold, which is equal to net profits. Therefore, .09 of value

of goods sold = \$9000; .01 of value of goods sold = \$1000; the value of the goods sold = \$100000, *Ans.*

$$24. \left(\frac{2}{3} - \frac{1}{10}\right) \times \left(3 + \frac{2}{3}\right) = \frac{17}{30} \times \frac{17}{3}; \text{ and } \left(1\frac{1}{2} + \frac{5}{7}\right) + \left(3 - 1\frac{2}{3}\right) \times 5 = 2\frac{3}{4} + 6\frac{2}{3} = 8\frac{17}{12} = \frac{37}{3}; \text{ and } \frac{1}{3} \times \frac{17}{3} = \frac{17}{9} = .216\bar{6}, \text{ } Ans.$$

$$25. \$.65 \times 5000 = \$3250, \text{ the cost of corn;} \\ .25 \text{ of } 5000 \text{ bu.} = 1250 \text{ bu.;} \\ \$.70 \times 1250 = \$875, \text{ value of .25 sold;} \\ \$3250 + \$447.50 = \$3697.50, \text{ entire receipts;} \\ \$3697.50 - \$875 = \$2822.50, \text{ am't rec'd for 2d sale;} \\ 5000 \text{ bu.} - 1250 \text{ bu.} = 3750 \text{ bu., quant'y sold at 2d sale;} \\ \$2822.50 \div 3750 = \$.75\frac{4}{5}, \text{ price per bu. of remainder.}$$

$$26. \text{ He sold } \frac{2275}{6000} = \frac{91}{240} = .35, \text{ } Ans.$$

$$27. 645\frac{1}{2} = 645.2; \text{ and } .37\frac{1}{2} = \frac{3}{8}; \\ 645.2 \text{ bu.} \times \frac{3}{8} = 241.95 \text{ bu., A's share;} \\ 645.2 \text{ bu.} \times \frac{2}{8} = 120.975 \text{ bu., B's share;} \\ 241.95 \text{ bu.} + 120.975 \text{ bu.} = 362.925 \text{ bu.;} \\ 645.2 \text{ bu.} - 362.925 \text{ bu.} = 282.275 \text{ bu., C's share.}$$

DENOMINATE NUMBERS.

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$$2. £2 \times 20 + 10s. = 50s.; 50s. \times 12 + 6d. = 606d., \text{ } Ans.$$

$$3. £13 \times 20 + 5s. = 265s., \text{ } Ans.$$

$$4. £4 \times 20 + 6s. = 86s.; 86s. \times 12 + 5d. = 1037d.; \\ 1037d. \times 4 = 4148 \text{ far., } Ans.$$

6. $\text{£}\frac{3}{8} \times 20 \times 12 = 90\text{d.}$, *Ans.*
7. $\text{£}\frac{7}{5} \times 20 \times 12 = 210\text{d.}$, *Ans.*
8. $\frac{5}{8}\text{s.} \times 12 \times 4 = 26\frac{2}{3}\text{ far.}$, *Ans.*
9. $\text{£}\frac{5}{11} \times 20 \times 12 = \frac{1200}{11} = 109\frac{1}{11}\text{d.}$, *Ans.*
10. $\text{£}5 \times 20 + 6\text{s.} = 106\text{s.}$; $106\text{s.} \times 12 \times 4 = 5088\text{ far.}$
11. $12\text{s.} \times 12 + 5\text{d.} = 149\text{d.}$; $149\text{d.} \times 4 + 2\text{ far.} = 598\text{ far.}$
12. $\text{£}7 \times 20 + 9\text{s.} = 149\text{s.}$; $149\text{s.} \times 12 + 5\text{d.} = 1793\text{d.}$
13. $17\text{s.} \times 12 + 6\text{d.} = 210\text{d.}$; $210\text{d.} \times 4 + 3\text{ far.} = 843\text{ far.}$
14. $\text{£}\frac{3}{8} \times 20 = \frac{60}{8}\text{s.}$, or $7\frac{1}{2}\text{s.}$; $\frac{1}{2}\text{s.} \times 12 = \frac{12}{2}\text{d.} = 6\text{d.}$. Therefore, $\text{£}\frac{3}{8} = 7\text{s. } 6\text{d.}$, *Ans.*
15. $\text{£}5 \times 20 + 13\text{s.} = 113\text{s.}$; $113\text{s.} \times 12 + 3\text{d.} = 1359\text{d.}$; $1359\text{d.} \times 4 = 5436\text{ far.}$, *Ans.*
16. $\text{£}35 \times 20 + 6\text{s.} = 706\text{s.}$; $706\text{s.} \times 12 + 8\text{d.} = 8480\text{d.}$, *Ans.*
17. $\text{£}45 \times 20 + 3\text{s.} = 903\text{s.}$; $903\text{s.} \times 12 + 9\text{d.} = 10845\text{d.}$; $10845\text{d.} \times 4 + 3\text{ far.} = 43383\text{ far.}$, *Ans.*
18. $\text{£}29 \times 20 + 18\text{s.} = 598\text{s.}$; $598\text{s.} \times 12 + 5\text{d.} = 7181\text{d.}$; $7181\text{d.} \times 4 = 28724\text{ far.}$, *Ans.*

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2. $345\text{ far.} \div 4 = 86\text{d. } 1\text{ far.}$; $86\text{d.} \div 12 = 7\text{s. } 2\text{d.}$. Therefore, $345\text{ far.} = 7\text{s. } 2\text{d. } 1\text{ far.}$, *Ans.*
3. $456\text{s.} \div 20 = \text{£}22\text{ } 16\text{s.}$, *Ans.*
4. $1586\text{d.} \div 12 = 132\text{s. } 2\text{d.}$; $132\text{s.} \div 20 = \text{£}6\text{ } 12\text{s.}$. Therefore, $1586\text{d.} = \text{£}6\text{ } 12\text{s. } 2\text{d.}$, *Ans.*
5. $3864\text{ far.} \div 4 = 966\text{d.}$; $966\text{d.} \div 12 = 80\text{s. } 6\text{d.}$; $80\text{s.} \div 20 = \text{£}4$. Therefore, $3864\text{ far.} = \text{£}4\text{ } 0\text{s. } 6\text{d.}$, *Ans.*

7. $\frac{3}{4}\text{s.} \times \frac{1}{20} + £\frac{3}{100}$, *Ans.*
8. $\frac{3}{4}\text{ far.} \times \frac{1}{4} \times \frac{1}{12} = \frac{1}{112}\text{s.}$, *Ans.*
9. $384\text{d.} \div 12 = 32\text{s.}$; $32\text{s.} \div 20 = £1\ 12\text{s.}$ Therefore, $384\text{d.} = £1\ 12\text{s.}$, *Ans.*
10. $3146\text{s.} \div 20 = £157\ 6\text{s.}$, *Ans.*
11. $3596\text{d.} \div 12 = 299\text{s.}\ 8\text{d.}$; $299\text{s.} \div 20 = £14\ 19\text{s.}$ Therefore, $3596\text{d.} = £14\ 19\text{s.}\ 8\text{d.}$, *Ans.*
12. $3846\text{ far.} \div 4 = 961\text{d.}\ 2\text{ far.}$; $961\text{d.} \div 12 = 80\text{s.}\ 1\text{d.}$ Therefore, $3846\text{ far.} = 80\text{s.}\ 1\text{d.}\ 2\text{ far.}$, *Ans.*
13. $4856\text{s.} \div 20 = £242\ 16\text{s.}$, *Ans.*
14. $5968\text{ far.} \div 4 = 1492\text{d.}$; $1492\text{d.} \div 12 = 124\text{s.}\ 4\text{d.}$; $124\text{s.} \div 20 = £6\ 4\text{s.}$ Therefore, $5968\text{ far.} = £6\ 4\text{s.}\ 4\text{d.}$
15. $3984\text{d.} \div 12 = 332\text{s.}$; $332\text{s.} \div 20 = £16\ 12\text{s.}$ Therefore, $3984\text{d.} = £16\ 12\text{s.}$, *Ans.*
16. $4685\text{ far.} \div 4 = 1171\text{d.}\ 1\text{ far.}$; $1171 \div 12 = 97\text{s.}\ 7\text{d.}$ Therefore, $4685\text{ far.} = 97\text{s.}\ 7\text{d.}\ 1\text{ far.}$, *Ans.*
17. $48567\text{ far.} \div 4 = 12141\text{d.}\ 3\text{ far.}$; $12141\text{d.} \div 12 = 1011\text{s.}\ 9\text{d.}$; $1011\text{s.} \div 20 = £50\ 11\text{s.}$ Therefore, $48567\text{ far.} = £50\ 11\text{s.}\ 9\text{d.}\ 3\text{ far.}$, *Ans.*
18. $£3 \times 20 + 14\text{s.} = 74\text{s.}$; $74\text{s.} \times 12 + 5\text{d.} = 893\text{d.}$; $893\text{d.} \times 4 = 3572\text{ far.}$, *Ans.*
19. $48596\text{ far.} \div 4 = 12149\text{d.}$; $12149\text{d.} \div 12 = 1012\text{s.}\ 5\text{d.}$; $1012\text{s.} \div 20 = £50\ 12\text{s.}$ Therefore, $48596\text{ far.} = £50\ 12\text{s.}\ 5\text{d.}$, *Ans.*
20. $£15 \times 20 + 8\text{s.} = 308\text{s.}$; $308\text{s.} \times 12 = 3696\text{d.}$; $3696\text{d.} \times 4 = 14784\text{ far.}$, *Ans.*
21. $\$4.8665 \times 15 = \72.9975 , *Ans.*

22. $\$456 \div \$4.8665 = \pounds 93 \frac{11}{11}$. Reducing the fraction to integers of lower denominations, $\pounds \frac{11}{11} = \pounds \frac{11}{11}$; $\frac{11}{11} \times 20 = \frac{11}{11} \text{ s.} = 14 \frac{11}{11} \text{ s.}$; $\frac{11}{11} \times 12 = \frac{11}{11} = \frac{1}{2} \text{ d., nearly.}$ Therefore, $\$456 = \pounds 93 \text{ 14s. } \frac{1}{2} \text{ d., nearly.}$
23. $\$394.45 \div \$4.8665 = \pounds 81 \frac{26}{11}$; $\pounds \frac{26}{11} = \frac{527}{11} \times 20 = \frac{10540}{11} \text{ s.} = 1 \frac{807}{11} \text{ s.}$; $\frac{807}{11} \times 12 = \frac{9684}{11} = 1 \text{ d., nearly.}$ Therefore, $\$394.45 = \pounds 81 \text{ 1s. 1d., nearly, Ans.}$
24. $\$37.50 \div \$4.8665 = \pounds 7 \frac{11}{11}$; $\pounds \frac{11}{11} = \frac{11}{11} \times 20 = \frac{11}{11} \text{ s.} = 14 \frac{11}{11} \text{ s.}$; $\frac{11}{11} \times 12 = \frac{11}{11} \text{ d.} = 1 \frac{11}{11} \text{ d., or } 1 \frac{1}{2} \text{ d., nearly.}$ Therefore, $\$37.50 = \pounds 7 \text{ 14s. } 1 \frac{1}{2} \text{ d., nearly. Ans.}$
25. $\$4.8665 \times 25 = \$121.66 \frac{1}{4}$, *Ans.*
26. $\pounds 15 \times 20 + 10 \text{ s.} = 310 \text{ s.}$; $310 \text{ s.} \times 12 = 3720 \text{ d.}$; $3720 \text{ d.} \times 4 = 14880 \text{ far., Ans.}$
27. $\$973.30 \div \$4.8665 = \pounds 200$, *Ans.*
28. $\$1216.625 \div 4.8665 = \pounds 250$, *Ans.*

LINEAR MEASURES.

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14. $5 \text{ mi.} \times 320 + 18 \text{ rd.} = 1618 \text{ rd.}$; $1618 \text{ rd.} \times 5 \frac{1}{2} + 4 \text{ yd.} = 8903 \text{ yd., Ans.}$
15. $7 \text{ rd.} \times 16 \frac{1}{2} + 5 \text{ ft.} = 120 \frac{1}{2} \text{ ft.}$; $120 \frac{1}{2} \text{ ft.} \times 12 + 6 \text{ in.} = 1452 \text{ in., Ans.}$

16. $63360 \text{ in.} \times 7 = 443520 \text{ in.}$, *Ans.*
 $63360 \text{ in.} \times 9 = 570240 \text{ in.}$, *Ans.*
17. $327 \text{ ft.} \div 16\frac{1}{2} = 327 \times \frac{2}{33} = \frac{2118}{33} = 19\frac{8}{11} \text{ rd.}$, *Ans.*
18. $36828 \text{ in.} \div 12 = 3069 \text{ ft.}$; $3069 \text{ ft.} \div 16\frac{1}{2} = 186 \text{ rd.}$
19. $3960 \text{ rd.} \div 320 = 12\frac{3}{8} \text{ mi.}$, *Ans.*
20. $15 \text{ mi.} \times 320 + 8 \text{ rd.} = 4808 \text{ rd.}$; $4808 \text{ rd.} \times 5\frac{1}{2} + 5 \text{ yd.}$
 $= 26449 \text{ yd.}$; $26449 \text{ yd.} \times 3 + 3 \text{ ft.} = 79350 \text{ ft.}$; 79350
 $\text{ft.} \times 12 + 4 \text{ in.} = 952204 \text{ in.}$, *Ans.*
21. $8 \text{ mi.} \times 320 + 14 \text{ rd.} = 2574 \text{ rd.}$; $2574 \text{ rd.} \times 16\frac{1}{2} + 5$
 $\text{ft.} = 42476 \text{ ft.}$; $42476 \text{ ft.} \times 12 + 4 \text{ in.} = 509716 \text{ in.}$
22. $66454 \text{ in.} \div 12 = 5537 \text{ ft. } 10 \text{ in.}$; $5537 \text{ ft.} \div 3 = 1845$
 $\text{yd. } 2 \text{ ft.}$; $1845 \text{ yd.} \div 5\frac{1}{2} = 335 \text{ rd. } 2\frac{1}{2} \text{ yd.}$; $335 \text{ rd.} \div$
 $320 = 1 \text{ mi. } 15 \text{ rd.}$. Therefore, $66454 \text{ in.} = 1 \text{ mi. } 15 \text{ rd.}$
 $2\frac{1}{2} \text{ yd. } 2 \text{ ft. } 10 \text{ in.}$; or, since $\frac{1}{2} \text{ yd.} = 1 \text{ ft. } 6 \text{ in.}$, it may
be expressed: $1 \text{ mi. } 15 \text{ rd. } 3 \text{ yd. } 1 \text{ ft. } 4 \text{ in.}$, *Ans.*
23. $158964 \text{ in.} \div 12 = 13247 \text{ ft.}$; $13247 \text{ ft.} \div 3 = 4415 \text{ yd.}$
 2 ft. ; $4415 \text{ yd.} \div 5\frac{1}{2} = 802 \text{ rd. } 4 \text{ yd.}$; $802 \text{ rd.} \div 320$
 $= 2 \text{ mi. } 162 \text{ rd.}$. Therefore, $158964 \text{ in.} = 2 \text{ mi. } 162 \text{ rd.}$
 $4 \text{ yd. } 2 \text{ ft.}$, *Ans.*

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24. $5280 \text{ ft.} \times 7912 = 41775360 \text{ ft.}$, *Ans.*
25. $4 \text{ in.} \times 15 = 60 \text{ in.}$; $60 \text{ in.} \div 12 = 5 \text{ ft.}$, *Ans.*
26. $67 \text{ ch. } 83 \text{ l.} = 6783 \text{ l.}$. Since $25 \text{ l.} = 1 \text{ rd.}$, $6783 \text{ l.} \div 25$
 $=$ the number of rods, which is $271 \text{ rd. } 8 \text{ l.}$, *Ans.*
27. $59 \text{ ch.} \times 100 + 75 \text{ l.} = 5975 \text{ l.}$; $5975 \text{ l.} \times 7.92 = 47322$
 in. , *Ans.*

SURFACE MEASURES.**Page 169.**

10. $9 \text{ sq. yd.} \times 9 + 3 \text{ sq. ft.} = 84 \text{ sq. ft.}; 84 \text{ sq. ft.} \times 144 + 15 \text{ sq. in.} = 12111 \text{ sq. in.}, \text{ Ans.}$
11. $3 \text{ sq. mi.} \times 102400 + 15 \text{ sq. rd.} = 307215 \text{ sq. rd.}; 307215 \text{ sq. rd.} \times 30\frac{1}{4} = 9293253\frac{3}{4} \text{ sq. yd.}; 9293253\frac{3}{4} \text{ sq. yd.} \times 9 = 83639283\frac{3}{4} \text{ sq. ft.}; 83639283\frac{3}{4} \text{ sq. ft.} \times 144 = 12044056860 \text{ sq. in.}, \text{ Ans.}$
12. $262685 \text{ sq. ft.} \div 9 = 29187 \text{ sq. yd. } 2 \text{ sq. ft.}; 29187 \text{ sq. yd.} \div 30\frac{1}{4} = 964 \text{ sq. rd. } 26 \text{ sq. yd.}; 964 \text{ sq. rd.} \div 160 = 6 \text{ A. } 4 \text{ sq. rd.}$ Therefore, $262685 \text{ sq. ft.} = 6 \text{ A. } 4 \text{ sq. rd. } 26 \text{ sq. yd. } 2 \text{ sq. ft.}, \text{ Ans.}$
13. $2 \text{ A.} \times 160 + 37 \text{ sq. rd.} = 357 \text{ sq. rd.}; 357 \text{ sq. rd.} \times 30\frac{1}{4} + 5 \text{ sq. yd.} = 10804\frac{1}{4} \text{ sq. yd.}; 10804\frac{1}{4} \text{ sq. yd.} \times 9 + 7 \text{ sq. ft.} = 97245\frac{1}{4} \text{ sq. ft.}; 97245\frac{1}{4} \text{ sq. ft.} \times 144 = 14003316 \text{ sq. in.}, \text{ Ans.}$
14. $184265 \text{ sq. in.} \div 144 = 1279 \text{ sq. ft. } 89 \text{ sq. in.}; 1279 \text{ sq. ft.} \div 9 = 142 \text{ sq. yd. } 1 \text{ sq. ft.}; 142 \text{ sq. yd.} \div 30\frac{1}{4} = 4 \text{ sq. rd. } 21 \text{ sq. yd.}$ Therefore, $184265 \text{ sq. in.} = 4 \text{ sq. rd. } 21 \text{ sq. yd. } 1 \text{ sq. ft. } 89 \text{ sq. in.}, \text{ Ans.}$

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16. $\frac{5}{8} \text{ A.} \times 160 = 88\frac{5}{8} \text{ sq. rd.}; \frac{5}{8} \text{ sq. rd.} \times 30\frac{1}{4} = 26\frac{5}{8} \text{ sq. yd.}; \frac{5}{8} \text{ sq. yd.} \times 9 = 8 \text{ sq. ft.}$ Therefore, $\frac{5}{8} \text{ A.} = 88 \text{ sq. rd. } 26 \text{ sq. yd. } 8 \text{ sq. ft.}, \text{ Ans.}$
17. $\frac{100}{180} = \frac{5}{9}; \frac{80}{180} = \frac{4}{9}; \frac{120}{180} = \frac{2}{3}, \text{ Ans.}$

18. $\frac{3}{8}$ sq. rd. $\times 30\frac{1}{4} = 11\frac{1}{2}$ sq. yd.; $\frac{1}{2}$ sq. yd. $\times 9 = \frac{9}{2} = 3\frac{3}{2}$ sq. ft.; $\frac{3}{2}$ sq. ft. $\times 144 = 13\frac{1}{2}$ sq. in. Therefore, $\frac{3}{8}$ sq. rd. = 11 sq. yd. 3 sq. ft. $13\frac{1}{2}$ sq. in., *Ans.*
23. $18 \times 24 = 432$ sq. ft.; 432 sq. ft. $\div 9 = 48$ sq. yd.; $\$1.15 \times 48 = \55.20 , the cost of carpet, *Ans.*
24. $18 \times 17 = 306$ sq. ft.; 306 sq. ft. $\div 9 = 34$ sq. yd.
25. $18 \times 15\frac{3}{4} = 283\frac{1}{2}$ sq. ft.; $283\frac{1}{2}$ sq. ft. $\div 9 = 31\frac{1}{2}$ sq. yd.; $31\frac{1}{2}$ sq. yd. $\div \frac{3}{4} = 42$, the number of yards of carpet; $\$1.90 \times 42 = \79.80 , the cost of carpet, *Ans.*
26. $\frac{1}{4}$ A. = 40 sq. rd. $\times 30\frac{1}{4} \times 9 = 10890$ sq. ft. Since the area is the product of the length by the breadth, if 10890, the area, is divided by 66, the breadth, the quotient will be the length. $10890 \div 66 = 165$ ft., the length; $\$3.25 \times 10890 = \35392.50 , cost of lot, *Ans.*
27. 10 A. $\times 160 = 1600$ sq. rd. Since the area, 1600 sq. rd., is the product of the length by the breadth, if it is divided by 20 rd., the breadth, the quotient will be the length. $1600 \div 20 = 80$ rd., the length, *Ans.*

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28. $80 \times 20 = 1600$ sq. rd.; 1600 sq. rd. $\div 160 = 10$ A.; $\$47.25 \times 10 = \472.50 , *Ans.*
29. A surface 10 ft. sq. contains 100 sq. ft.; 100 sq. ft. — 10 sq. ft. = 90 sq. ft., *Ans.*
30. $48 \times 22 = 1056$ sq. ft.; 1056 sq. ft. $\div 9 = 117\frac{1}{3}$ sq. yd.; $\$.30 \times 117\frac{1}{3} = \35.20 , *Ans.*
31. $45 \times 32 = 1440$ sq. ft.; 1440 sq. ft. $\div 9 = 160$ sq. yd.; $\$.30 \times 160 = \48 , *Ans.*

32. $18 \times 11 = 198$ sq. ft., the area of one side ;
 198 sq. ft. $\times 2 = 396$ sq. ft., the area of two equal sides ;
 $17 \times 11 = 187$ sq. ft., the area of another side ;
 187 sq. ft. $\times 2 = 374$ sq. ft., area of other two equal sides ;
 396 sq. ft. $+ 374$ sq. ft. $= 770$ sq. ft., in sides ;
 770 sq. ft. $\div 9 = 85\frac{5}{9}$ sq. yd., in sides ;
 $18 \times 17 = 306$ sq. ft., in ceiling ;
 306 sq. ft. $\div 9 = 34$ sq. yd., in ceiling ;
 $85\frac{5}{9}$ sq. yd. $+ 34$ sq. yd. $= 119\frac{5}{9}$ sq. yd., whole area ;
 $\$.37 \times 119\frac{5}{9} = \44.23 , the cost, *Ans.*
33. $\$.25 \times 85\frac{5}{9} = \21.39 , *Ans.*
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MEASURES OF VOLUME.

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4. 418 cu. ft. $\div 24\frac{3}{4} = 16\frac{2}{3}$ perch ; $\$1.75 \times 16\frac{2}{3} = \29.56 .
5. $38 \times 4 \times 1\frac{1}{2} = 228$ cu. ft. ; 228 cu. ft. $\div 24\frac{3}{4} = 9\frac{7}{8}$ perch.
6. $35 \times 20 \times 8 = 5600$ cu. ft. ; 5600 cu. ft. $\div 27 = 207\frac{11}{27}$ cu. yd., or loads, *Ans.*
7. 32 cu. ft. $\times 1728 + 114$ cu. in. $= 55410$ cu. in., *Ans.*
8. 13 cu. yd. $\times 27 + 18$ cu. ft. $= 369$ cu. ft., *Ans.*
9. 15 perch $\times 24\frac{3}{4} + 13\frac{1}{2}$ cu. ft. $= 384\frac{1}{2}$ cu. ft., *Ans.*
10. $8 \times 8 \times 8 = 512$ cu. yd. ; 512 cu. yd. $\times 27 = 13824$ cu. ft., the contents of the cube ; or it contains 13824 blocks, each a cubic foot, *Ans.*
11. $9 \times 5 \times 3\frac{1}{2} = 157\frac{1}{2}$ cu. ft., *Ans.*

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12. $40 \times 4 \times 5\frac{1}{2} = 880$ cu. ft.; 880 cu. ft. $\div 128 = 6\frac{7}{8}$ C.;
 $\$1.50 \times 6\frac{7}{8} = \$10.31\frac{1}{4}$, *Ans.*
13. $8 \times 7 \times 5 = 280$ cu. ft.; 280 cu. ft. $\times 1728 = 483840$
 cu. in.; 483840 cu. in. $\div 2150.4 = 225$ bu., *Ans.*
14. $80 \times 35 \times 8 = 22400$ cu. ft.; 22400 cu. ft. $\div 27 =$
 $829\frac{1}{3}$ cu. yd.; $\$.42 \times 829\frac{1}{3} = \348.44 ; $80 + 35 =$
 115 ft., half the length of wall according to measure-
 ment of masons. Therefore the length of wall is 230 ft.
 $230 \times 8 \times 1\frac{1}{2} = 2760$ cu. ft.; 2760 cu. ft. $\div 24\frac{3}{4} = 111\frac{1}{8}$
 perch; $\$3.75 \times 111\frac{1}{8} = \418.18 , the cost of wall, *Ans.*
15. $35\frac{1}{2} \times 19 \times 3 = 2023\frac{1}{2}$ cu. ft.; $2023\frac{1}{2} \times 22 = 44517$
 bricks, *Ans.*

BOARD MEASURE.**Page 174.**

1. 16 in. $= 1\frac{1}{3}$ ft.; $18 \times 1\frac{1}{3} = 24$ ft., *Ans.*
2. $15 \times 11 = 165$; $165 \div 12 = 13\frac{3}{4}$ ft., *Ans.*
3. $10 \times 13 = 130$; $130 \div 12 = 10\frac{5}{6}$ ft., *Ans.*
4. $13 \times 15 = 195$; $195 \div 12 = 16\frac{1}{4}$ ft., *Ans.*

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5. $40 \times 9 = 360$; $360 \div 12 = 30$ ft.; 30 ft. $\times 6 = 180$ ft.
6. $16 \times 8 = 128$; $128 \div 12 = 10\frac{2}{3}$; $10\frac{2}{3} \times 318 = 3392$ ft.,
 or 3.392 thousand; $\$11 \times 3.392 = \37.312 , the cost.

7. $22 \times 16 = 352$; $352 \div 12 = 29\frac{1}{3}$ ft.; $29\frac{1}{3} \times 3 = 88$ ft. in each plank; $88 \times 35 = 3080$ ft., or 3.08 thousand; $\$17.50 \times 3.08 = \53.90 , the cost, *Ans.*
8. $35 \times 18 = 630$ ft.; $\frac{1}{3}$ of 630 = 105, and 630 ft. + 105 ft. = 735 ft.; $735 \times 1\frac{1}{4} = 918\frac{3}{4}$ ft., board measure, or .918 $\frac{3}{4}$ thousand; $\$30 \times .918\frac{3}{4} = \$27.56\frac{1}{4}$, *Ans.*
9. $20 \times 25 = 500$ ft.; $\frac{1}{8}$ of 500 = $62\frac{1}{2}$, and 500 ft. + $62\frac{1}{2}$ ft. = $562\frac{1}{2}$ ft.; $562\frac{1}{2} \times 1\frac{1}{2} = 843\frac{3}{4}$ ft., board measure, or .843 $\frac{3}{4}$ thousand; $\$25 \times .843\frac{3}{4} = \$21.09\frac{3}{8}$, *Ans.*

LIQUID MEASURE.

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5. $684 \text{ pt.} \div 8 = 85\frac{1}{2} \text{ gal.}$; $\$.20 \times 85\frac{1}{2} = \17.10 , *Ans.*
6. $3846 \text{ gi.} \div 4 = 961 \text{ pt. } 2 \text{ gi.}$; $961 \text{ pt.} \div 2 = 480 \text{ qt. } 1 \text{ pt.}$; $480 \text{ qt.} \div 4 = 120 \text{ gal.}$ Therefore, 3846 gi. = 120 gal. 1 pt. 2 gi., *Ans.*— $4869 \text{ pt.} \div 2 = 2434 \text{ qt. } 1 \text{ pt.}$; $2434 \text{ qt.} \div 4 = 608 \text{ gal. } 2 \text{ qt.}$ Therefore, 4869 pt. = 608 gal. 2 qt. 1 pt., *Ans.*
7. $3 \text{ gal.} \times 4 + 4 \text{ qt.} = 16 \text{ qt.}$; $16 \text{ qt.} \times 2 + 1 \text{ pt.} = 33 \text{ pt.}$; $33 \text{ pt.} \times 4 + 3 \text{ gi.} = 135 \text{ gi.}$, *Ans.*
8. $4 \text{ bbl.} \times 31\frac{1}{2} + 6 \text{ gal.} = 132 \text{ gal.}$; $132 \text{ gal.} \times 4 = 528 \text{ qt.}$; $528 \text{ qt.} \times 2 = 1056 \text{ pt.}$; $1056 \text{ pt.} \times 4 = 4224 \text{ gi.}$, *Ans.*— $484 \text{ pt.} \div 2 = 242 \text{ qt.}$; $242 \text{ qt.} \div 4 = 60 \text{ gal. } 2 \text{ qt.}$, *Ans.*

9. $24 \text{ gal.} \times 8 = 192 \text{ pt.}$, *Ans.*— $8459 \text{ gi.} \div 4 = 2114 \text{ pt. } 3 \text{ gi.}$; $2114 \text{ pt.} \div 2 = 1057 \text{ qt.}$; $1057 \text{ qt.} \div 4 = 264 \text{ gal. } 1 \text{ qt.}$; $264 \text{ gal.} \div 31\frac{1}{2} = 8 \text{ bbl. } 12 \text{ gal.}$ Therefore, $8459 \text{ gi.} = 8 \text{ bbl. } 12 \text{ gal. } 1 \text{ qt. } 3 \text{ gi.}$, *Ans.*
10. $231 \text{ cu. in.} \times 7 = 1617 \text{ cu. in.}$, *Ans.*
11. $3846 \text{ cu. in.} \div 231 \text{ cu. in.} = 16\frac{4}{7}$, number of gallons.
12. $15 \times 10 \times 8 = 1200 \text{ cu. ft.}$; $1200 \times 1728 = 2073600 \text{ cu. in.}$; $2073600 \div 231 = 8976.623 \text{ gal.}$; $8976.623 \div 31\frac{1}{2} = 284 \text{ bbl. } 30.623 \text{ gal.}$, *Ans.*
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DRY MEASURE.

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4. $3 \text{ bu.} \times 4 + 3 \text{ pk.} = 15 \text{ pk.}$; $15 \text{ pk.} \times 8 + 5 \text{ qt.} = 125 \text{ qt.}$; $125 \text{ qt.} \times 2 + 1 \text{ pt.} = 251 \text{ pt.}$, *Ans.*
5. $8 \text{ bu.} \times 4 = 32 \text{ pk.}$; $32 \text{ pk.} \times 8 + 5 \text{ qt.} = 261 \text{ qt.}$; $261 \text{ qt.} \times 2 + 3 \text{ pt.} = 525 \text{ pt.}$, *Ans.*
6. $16845 \text{ qt.} \div 8 = 2105 \text{ pk. } 5 \text{ qt.}$; $2105 \text{ pk.} \div 4 = 526 \text{ bu. } 1 \text{ pk.}$ Therefore, $16845 \text{ qt.} = 526 \text{ bu. } 1 \text{ pk. } 5 \text{ qt.}$, *Ans.*

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7. $13965 \text{ pt.} \div 2 = 6982 \text{ qt. } 1 \text{ pt.}$; $6982 \text{ qt.} \div 8 = 872 \text{ pk. } 6 \text{ qt.}$; $872 \text{ pk.} \div 4 = 218 \text{ bu.}$ Therefore, $1365 \text{ qt.} = 218 \text{ bu. } 6 \text{ qt. } 1 \text{ pt.}$, *Ans.*

8. $57364 \text{ qt.} \div 8 = 7170 \text{ pk. } 4 \text{ qt.}$; $7170 \text{ pk.} \div 4 = 1792 \text{ bu. } 2 \text{ pk.}$ Therefore, $57364 \text{ qt.} = 1792 \text{ bu. } 2 \text{ pk. } 4 \text{ qt.}$
9. $35 \text{ bu.} \times 4 + 3 \text{ pk.} = 143 \text{ pk.}$; $143 \text{ pk.} \times 8 + 6 \text{ qt.} = 1150 \text{ qt.}$; $1150 \text{ qt.} \times 2 + 1 \text{ pt.} = 2301 \text{ pt.}$, *Ans.*
10. $2150.4 \text{ cu. in.} \times 7 = 15052.8 \text{ cu. in.}$, *Ans.*
11. $13846 \text{ cu. in.} \div 2150.4 = 6.4388 + \text{bu.}$, *Ans.*
12. $8 \times 7 \times 5 = 280 \text{ cu. ft.}$; $280 \text{ cu. ft.} \times 1728 = 483840 \text{ cu. in.}$; $483840 \text{ cu. in.} \div 2150.4 \text{ cu. in.} = 225 \text{ bu.}$, *Ans.*
13. $9 \times 6 \times 6 = 324 \text{ cu. ft.}$; $324 \text{ cu. ft.} \times 1728 = 559872 \text{ cu. in.}$; $559872 \text{ cu. in.} \div 2150.4 \text{ cu. in.} = 260.357 \text{ bu.}$

MEASURES OF WEIGHT.

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4. $3 \text{ T.} \times 20 + 2 \text{ cwt.} = 62 \text{ cwt.}$; $62 \text{ cwt.} \times 100 + 5 \text{ lb.} = 6205 \text{ lb.}$, *Ans.*
5. $5 \text{ T.} \times 2000 + 216 \text{ lb.} = 10216 \text{ lb.}$, *Ans.*
6. $5 \text{ lb.} \times 16 + 7 \text{ oz.} = 87 \text{ oz.}$; $\$.12\frac{1}{2} \times 87 = \10.875 .
7. $3\frac{1}{2} \text{ lb.} \times 16 = 56 \text{ oz.}$; $\$.04\frac{1}{2} \times 56 = \2.52 , *Ans.*
8. $5 \text{ cwt. } 28 \text{ lb.} = 528 \text{ lb.}$; $\$.08 \times 528 = \42.24 , *Ans.*

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10. $\frac{1}{4} \text{ bbl.} = \frac{1}{4} \text{ of } 196 \text{ lb.}$, or 49 lb. Flour at $\$8.50$ per cwt. is $\$.085$ per lb.; $\$.085 \times 49 = \4.165 , *Ans.*

11. $\frac{1}{2}$ quintal = $\frac{1}{2}$ of 100 lb., or 50 lb.; and $\$.06\frac{1}{2} \times 50 = \3.25 , *Ans.*
12. 13 cwt. 18 lb. = 1318 lb., or 1.318 thousand pounds; and since hay is \$15 for 2000 lb., it is $\frac{1}{2}$ of \$15, or \$7.50, for 1000 lb. Therefore, $\$7.50 \times 1.318 = \9.885 .
13. When flour is \$10 per bbl., 1 lb. = $\frac{1}{168}$ of \$10, or $\$.05\frac{5}{8}$. Therefore as many pounds can be bought for \$2.80 as $\$.05\frac{5}{8}$ is contained times in that sum, which is $54.8 +$ lb., *Ans.*
14. 3 cwt. 19 lb. 9 oz. = $319\frac{9}{16}$ lb.; $\$.17 \times 319\frac{9}{16} = \$54.32\frac{9}{16}$.
15. $\$9 \times 15 = \135 , the cost of flour; $196 \times 15 = 2940$ lb., or 29.40 centals, the quantity of flour; $\$5 \times 29.40 = \147 ; and $\$147 - \$135 = \$12$, the gain, *Ans.*
16. $275000 \text{ lb.} \div 280 \text{ lb.} = 982\frac{1}{4}$ bbl., *Ans.*
17. 3 T. 4 cwt. 20 lb. = 6420 lb.; 2 bu. = 120 lb.; $6420 \text{ lb.} \div 120 \text{ lb.} = 53\frac{1}{2}$, or 54 bags, *Ans.*

APOTHECARIES' WEIGHT.

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3. $7 \text{ oz.} \times 20 + 5 \text{ pwt.} = 145 \text{ pwt.}$; $145 \text{ pwt.} \times 24 + 18 \text{ gr.} = 3498 \text{ gr.}$, *Ans.*
4. $3456 \text{ gr.} \div 24 = 144 \text{ pwt.}$; $144 \text{ pwt.} \div 20 = 7 \text{ oz.}$ 4 pwt., *Ans.*
5. 2 oz. 15 pwt. = 55 pwt.; $\$1.35 \times 55 = \74.25 , *Ans.*

6. 3 lb. 5 oz. = 41 oz.; $41 \text{ oz.} \div 5 \text{ oz.} = 8 \text{ spoons, and } 1 \text{ oz. remaining, } \textit{Ans.}$
7. 5 oz. 7 dr. = 47 dr.; $47 \text{ dr.} \times 3 = 141 \text{ sc.}; 141 \text{ sc.} \times 20 = 2820 \text{ gr.}; 2820 \text{ gr.} \div 5 = 564, \text{ number of powders.}$
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MEASURES OF TIME.

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8. $5 \text{ hr.} \times 60 + 15 \text{ min.} = 315 \text{ min.}; 315 \text{ min.} \times 60 + 12 \text{ sec.} = 18912 \text{ sec., } \textit{Ans.}$
9. $6 \text{ hr.} \times 60 + 27 \text{ min.} = 387 \text{ min.}; 387 \text{ min.} \times 60 + 38 \text{ sec.} = 23258 \text{ sec., } \textit{Ans.}$
10. $48695 \text{ sec.} \div 60 = 811 \text{ min. } 35 \text{ sec.}; 811 \text{ min.} \div 60 = 13 \text{ hr. } 31 \text{ min.}$ Therefore, $48695 \text{ sec.} = 13 \text{ hr. } 31 \text{ min. } 35 \text{ sec., } \textit{Ans.}$
11. $38497 \text{ sec.} \div 60 = 641 \text{ min. } 37 \text{ sec.}; 641 \text{ min.} \div 60 = 10 \text{ hr. } 41 \text{ min.}$ Therefore, $38497 \text{ sec.} = 10 \text{ hr. } 41 \text{ min. } 37 \text{ sec., } \textit{Ans.}$
12. $365 \text{ da.} \times 5 = 1825 \text{ da.}; 1825 \text{ da.} \times 24 = 43800 \text{ hr.}; 43800 \text{ hr.} \times 60 = 2628000 \text{ min., } \textit{Ans.}$
13. Jan., 31 da. + Feb., 28 da. + Mar., 31 da. + April, 30 da. = 120 da., *Ans.*
14. April, 30 da. + May, 31 da. + June, 30 da. + July, 31 da. + Aug., 31 da. + Sept., 30 da. + Oct., 14 da. = 197 da., *Ans.*

15. $2 \text{ wk.} \times 7 + 5 \text{ da.} = 19 \text{ da.}; 19 \text{ da.} \times 24 + 13 \text{ hr.} = 469 \text{ hr., Ans.}$
16. $5 \text{ da.} \times 24 + 10 \text{ hr.} = 130 \text{ hr.}; 130 \text{ hr.} \times 60 + 15 \text{ min.} = 7815 \text{ min., Ans.}$
17. $384600 \text{ sec.} \div 60 = 6410 \text{ min.}; 6410 \text{ min.} \div 60 = 106 \text{ hr. } 50 \text{ min.}; 106 \text{ hr.} \div 24 = 4 \text{ da. } 10 \text{ hr.}$ Therefore, $384600 \text{ sec.} = 4 \text{ da. } 10 \text{ hr. } 50 \text{ min., Ans.}$
18. $15 \text{ hr.} \times 60 + 12 \text{ min.} = 912 \text{ min.}; 912 \text{ min.} \times 60 + 18 \text{ sec.} = 54738 \text{ sec., Ans.}$
19. $32965 \text{ min.} \div 60 = 549 \text{ hr. } 25 \text{ min.}; 549 \text{ hr.} \div 24 = 22 \text{ da. } 21 \text{ hr.}; 22 \text{ da.} \div 7 = 3 \text{ wk. } 1 \text{ da.}$ Therefore, $32965 \text{ min.} = 3 \text{ wk. } 1 \text{ da. } 21 \text{ hr. } 25 \text{ min., Ans.}$
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CIRCULAR MEASURE.

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2. $21^\circ \times 60 + 12' = 1272'; 1272' \times 60 + 18'' = 76338''.$
3. $34^\circ \times 60 + 12' = 2052'; 2052' \times 60 + 43'' = 123163''.$
4. $468560'' \div 60 = 7809' 20''; 7809' \div 60 = 130^\circ 9'.$
Therefore, $468560'' = 130^\circ 9' 20'', \text{ Ans.}$
5. $384500'' \div 60 = 6408' 20''; 6408' \div 60 = 106^\circ 48'.$
Therefore, $384500'' = 106^\circ 48' 20'', \text{ Ans.}$

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6. $20 \times 3 = 60 \text{ quires}; \$.15 \times 60 = \$9.00, \text{ Ans.}$

DENOMINATE FRACTIONS.**Page 187.**

8. $\frac{2}{3}$ of a pound Troy = $\frac{2}{3}$ of 12 oz. = $\frac{24}{3}$ oz. = $7\frac{1}{3}$ oz.; $\frac{1}{3}$ oz. = $\frac{1}{6}$ of 20 pwt., or 4 pwt. Therefore, $\frac{2}{3}$ of a pound Troy = 7 oz. 4 pwt., *Ans.*
9. $\frac{3}{4}$ of a ton = $\frac{3}{4}$ of 2000 lb. = 857 $\frac{1}{2}$ lb.; $\frac{1}{4}$ lb. = $\frac{1}{16}$ of 16 oz. = 2 $\frac{1}{2}$ oz. Therefore, $\frac{3}{4}$ of a ton = 857 lb. 2 $\frac{1}{2}$ oz.
10. $\frac{2}{3}$ of a furlong = $\frac{2}{3}$ of 40 rd. = 26 $\frac{2}{3}$ rd.; $\frac{2}{3}$ rd. = $\frac{2}{3}$ of 5 $\frac{1}{2}$ yd. = 3 $\frac{2}{3}$ yd.; $\frac{2}{3}$ yd. = $\frac{2}{3}$ of 3 ft. = 2 ft. Therefore, $\frac{2}{3}$ of a furlong = 26 rd. 3 yd. 2 ft., *Ans.*
11. $\frac{2}{11}$ of an acre = $\frac{2}{11}$ of 160 sq. rd. = 43 $\frac{7}{11}$ sq. rd.; $\frac{7}{11}$ sq. rd. = $\frac{7}{11}$ of 30 $\frac{1}{4}$ sq. yd. = 19 $\frac{1}{4}$ sq. yd.; $\frac{1}{4}$ sq. yd. = $\frac{1}{4}$ of 9 sq. ft. = 2 $\frac{1}{4}$ sq. ft.; $\frac{1}{4}$ sq. ft. = $\frac{1}{4}$ of 144 sq. in. = 36 sq. in. Therefore, $\frac{2}{11}$ of an acre = 43 sq. rd. 19 sq. yd. 2 sq. ft. 36 sq. in., *Ans.*
12. $\frac{5}{8}$ of a peck = $\frac{5}{8}$ of 8 qt. = 6 $\frac{1}{2}$ qt.; $\frac{1}{2}$ qt. = $\frac{2}{3}$ of 2 pt. = 1 $\frac{1}{3}$ pt.; $\frac{1}{3}$ pt. = $\frac{1}{3}$ of 4 gi. = 1 $\frac{1}{3}$ gi. Therefore, $\frac{5}{8}$ of a peck = 6 qt. 1 pt. 1 $\frac{1}{3}$ gi., *Ans.*
13. $\frac{7}{10}$ of a day = $\frac{7}{10}$ of 24 hr. = 7 $\frac{1}{2}$ hr.; $\frac{1}{2}$ hr. = $\frac{1}{2}$ of 60 min. = 30 min. Therefore, $\frac{7}{10}$ of a day = 7 hr. 30 min.
14. $\frac{5}{8}$ of a sq. rd. = $\frac{5}{8}$ of 30 $\frac{1}{4}$ sq. yd. = 18 $\frac{3}{8}$ sq. yd.; $\frac{3}{8}$ sq. yd. = $\frac{3}{8}$ of 9 sq. ft. = 8 $\frac{5}{8}$ sq. ft.; $\frac{5}{8}$ sq. ft. = $\frac{5}{8}$ of 144 sq. in. = 22 $\frac{1}{2}$ sq. in. Therefore, $\frac{5}{8}$ of a sq. rd. = 18 sq. yd. 8 sq. ft. 22 $\frac{1}{2}$ sq. in., *Ans.*
15. $\frac{7}{20}$ of a cu. yd. = $\frac{7}{20}$ of 27 cu. ft. = 9 $\frac{9}{20}$ cu. ft.; $\frac{9}{20}$ cu. ft. = $\frac{9}{20}$ of 1728 cu. in. = 777 $\frac{3}{4}$ cu. in. Therefore, $\frac{7}{20}$ of a cu. yd. = 9 cu. ft. 777 $\frac{3}{4}$ cu. in., *Ans.*

17. Since there are 64 pints in a bushel, $\frac{11}{20}$ of a bu. = $\frac{11}{20}$ of 64 pt. = $7\frac{1}{5}$ pt. = $7\frac{1}{5}$ pt., *Ans.*
18. Since there are 5280 feet in a mile, $\frac{3}{20}$ of a mi. = $\frac{3}{20}$ of 5280 ft. = $158\frac{4}{5}$ ft. = $158\frac{4}{5}$ ft., *Ans.*
19. Since there are 288 scruples in a pound, $\frac{5}{14}$ of a lb. = $\frac{5}{14}$ of 288 sc. = $102\frac{3}{7}$ sc. = $102\frac{3}{7}$ sc., *Ans.*
20. Since there are 64 pints in a bushel, .006 of a bu. = .006 of 64 pt. = .384 pt., *Ans.*

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22. £.575 \times 20 = 11.5s.; .5s. \times 12 = 6d. Therefore, £.575 = 11s. 6d., *Ans.*
23. .1935 lb. Troy \times 12 = 2.322 oz.; .322 oz. \times 20 = 6.44 pwt.; .44 pwt. \times 24 = 10.56 gr. Therefore, .1935 lb. Troy = 2 oz. 6 pwt. 10.56 gr., *Ans.*
24. .436 of a ream \times 20 = 8.72 quires; .72 quires \times 24 = 17.28 sheets. Therefore, .436 of a ream = 8 quires 17.28 sheets, *Ans.*
25. .1845 of a gallon \times 4 = .738 qt.; .738 qt. \times 2 = 1.476 pt.; .476 pt. \times 4 = 1.904 gi. Therefore, .1845 of a gallon = 1 pt. 1.904 gi., *Ans.*
26. .135 of a rod = .135 of $16\frac{1}{2}$ ft. = 2.2275 ft.; .2275 ft. = .2275 of 12 in. = 2.73 in. Therefore, .135 of a rod = 2 ft. 2.73 in., *Ans.*
27. .455 of a mile = .455 of 320 rd. = 145.6 rd.; .6 rd. = .6 of $16\frac{1}{2}$ ft. = 9.9 ft.; .9 ft. = .9 of 12 in. = 10.8 in. Therefore, .455 of a mile = 145 rd. 9 ft. 10.8 in., *Ans.*

28. .4832 of a bushel = .4832 of 4 pk. = 1.9328 pk.; .9328 pk. = .9328 of 8 qt. = 7.4624 qt. Therefore, .4832 of a bushel = 1 pk. 7.4624 qt., *Ans.*
29. .684 of a league = .684 of 3 mi. = 2.052 mi.; .052 mi. = .052 of 320 rd. = 16.64 rd.; .64 rd. = .64 of $16\frac{1}{2}$ ft. = 10.56 ft.; .56 ft. = .56 of 12 in. = 6.72 in. Therefore, .684 of a league = 2 mi. 16 rd. 10 ft. 6.72 in., *Ans.*

8. 1 inch = $\frac{1}{36}$ of a yd.; and $\frac{5}{11}$ of an in. = $\frac{5}{11}$ of $\frac{1}{36}$ of a yd., or $\frac{5}{396}$ yd., *Ans.*
9. 1 second = $\frac{1}{86400}$ of an hr.; and $\frac{4}{9}$ of a sec. = $\frac{4}{9}$ of $\frac{1}{86400}$ of an hr., or $\frac{1}{51840}$ of an hr., *Ans.*
10. 1 day = $\frac{1}{365}$ of a yr.; therefore, 1 wk. = $\frac{7}{365}$ of a yr.; and .375 of a wk. = $\frac{375}{1000}$, or $\frac{3}{8}$ of $\frac{7}{365}$ of a yr., or $\frac{21}{2920}$ of a yr.
11. 1 pound = $\frac{1}{2000}$ of a ton; and .35 or $\frac{7}{20}$ lb. = $\frac{7}{20}$ of $\frac{1}{2000}$ of a ton, or $\frac{7}{40000}$ of a ton, *Ans.*
12. 1 cubic inch = $\frac{1}{1728}$ of a cu. ft.; and $\frac{3}{7}$ cu. in. = $\frac{3}{7}$ of $\frac{1}{1728}$, or $\frac{1}{4032}$ cu. ft., *Ans.*

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13. 1 square yard = $\frac{1}{4840}$ of an acre; and $\frac{3}{8}$ sq. yd. = $\frac{3}{8}$ of $\frac{1}{4840}$ = $\frac{3}{24200}$ acre, *Ans.*
14. 1 pint = $\frac{1}{256}$ of a bbl.; and $\frac{5}{9}$ pt. = $\frac{5}{9}$ of $\frac{1}{256}$, or $\frac{5}{2304}$ bbl.
-
6. Since 3 yd. 2 ft. = 11 ft., and 2 yd. 2 ft. = 8 ft., 8 ft. = $\frac{8}{11}$ of 11 ft., *Ans.*
7. Since 5 gal. 3 qt. 1 pt. = 47 pt., and 2 gal. 1 qt. 1 pt. = 19 pt., 19 pt. = $\frac{19}{47}$ of 47 pt., *Ans.*

8. Since 2 lb. = 480 pwt., and 3 oz. 10 pwt. = 70 pwt.,
70 pwt. = $\frac{70}{480}$, or $\frac{7}{48}$ of 480 pwt., *Ans.*
9. Since 3 pk. = 48 pt., and 2 qt. 1 pt. = 5 pt., 5 pt. =
 $\frac{5}{48}$ of 48 pt., *Ans.*
10. Since 3 bbl. = 3024 gi., and 13 gal. 3 qt. 2 pt. 2 gi. =
450 gi., 450 gi. = $\frac{450}{3024}$, or $\frac{225}{1512}$ of 3024 gi., *Ans.*

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| | | | |
|-----|----|--|---------------------------|
| 12. | 60 | | 15.00 min. |
| | 24 | | 4.25000 hr. |
| | | | .17708 + da., <i>Ans.</i> |

| | | | |
|-----|---|--|------------------------|
| 13. | 8 | | 2.00 qt. |
| | 4 | | 3.2500 pk. |
| | | | .8125 bu., <i>Ans.</i> |

| | | | |
|-----|-----|--|--------------------------|
| 14. | 12 | | 6.0 in. |
| | 16½ | | 3.5000 ft. |
| | | | .2121 + rd., <i>Ans.</i> |

15. 18s. 5½d. = 887 far., and
£1 = 960 far.; therefore,
18s. 5½d. = $\frac{887}{960}$ of a £,
or £.9239 +, *Ans.*

| | | | |
|-----|----|--|-------------------------|
| 16. | 4 | | 3.00 far. |
| | 12 | | 5.7500d. |
| | 20 | | 18.47916s. |
| | | | £.923958 +, <i>Ans.</i> |

17. 16 lb. 11 oz. = 267 oz.,
and 1 cwt. = 1600 oz.;
therefore, 16 lb. 11 oz. =
 $\frac{267}{1600}$ cwt., *Ans.*

| | | | |
|-----|-----|--|--------------------------|
| 18. | 12 | | 3.00 in. |
| | 16½ | | 14.2500 ft. |
| | 320 | | 37.8636 + rd. |
| | | | .1183 + mi., <i>Ans.</i> |

| | | | |
|-----|----|--|--------------------------|
| 19. | 60 | | 14.0000 min. |
| | 24 | | 5.2333 + hr. |
| | 7 | | 3.21805 + da. |
| | | | .45972 + wk. <i>Ans.</i> |

| | | | |
|--------|--------------------------|--------|---|
| 20. 24 | 15.000 sheets. | 21. 16 | 7.0000 cu. ft. |
| 20 | 8.62500 quires. | 8 | 3.4375 cd. ft. |
| | .43125 ream, <i>Ans.</i> | | .4296 + C., <i>Ans.</i> |
| 22. 36 | 9.00 in. | 23. | Since 4 oz. 7 pwt. 13 gr. |
| 1760 | 654.2500 yd. | | = 2101 gr., and 1 lb. = |
| | .3717 + mi., <i>Ans.</i> | | 5760 gr., 4 oz. 7 pwt. 13 |
| | | | gr. = $2\frac{11}{16}$ lb., <i>Ans.</i> |

REVIEW EXERCISES.
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- 15 lb. 8 oz. = $15\frac{1}{2}$ lb.; $\$.31 \times 15\frac{1}{2} = \4.805 , *Ans.*
- 3 pk. 2 qt. = 26 qt.; $\$.09 \times 26 = \2.34 , *Ans.*
- 18 bu. 3 pk. = $18\frac{3}{4}$ bu.; $\$1.05 \times 18\frac{3}{4} = \$19.68\frac{3}{4}$, *Ans.*
- 42 rd. 7 ft. 8 in. = $700\frac{2}{3}$ ft.; $\$.75 \times 700\frac{2}{3} = \525.50 .
- 12 gal. 3 qt. = $12\frac{3}{4}$ gal.; $\$.50 \times 12\frac{3}{4} = \6.375 ; and $\$6.375 \div \$.30 = 21.25$, or $21\frac{1}{4}$, No. lb. of butter, *Ans.*
- $\$.37\frac{1}{2} \times 15 = \5.625 , the cost of oats. In 15 bushels there are 120 half-pecks; therefore, $\$.15 \times 120 = \18 , the selling price; $\$18 - \$5.625 = \$12.375$, the gain.
- $4 \times 6 \times 60 = 1440$ cu. ft.; 1440 cu. ft. $\div 128 = 11\frac{1}{4}$ cords; $\$4.25 \times 11\frac{1}{4} = \$47.81\frac{1}{4}$, the cost of wood, *Ans.*
- Since there are 231 cu. in. in a gallon, a barrel will contain $31\frac{1}{2}$ times 231 cu. in., or $7276\frac{1}{2}$ cu. in.; and 100 barrels will contain 727650 cu. in., the volume of the cis-

tern. Since the volume is the product of three dimensions, when the product and two are given, the third dimension may be found by dividing the product by the product of the two given dimensions. $6 \text{ ft.} = 72 \text{ in.}$; $10 \text{ ft.} = 120 \text{ in.}$; $72 \times 120 = 8640 \text{ sq. in.}$; and $727650 \div 8640 = 84.2187 + \text{ in.}$; $84.2187 + \text{ in.} \div 12 = 7.0182 + \text{ ft.}$

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9. Since 1 oz. Troy = 480 gr., and 1 oz. Avoirdupois = $437\frac{1}{2}$ gr., it will require 1.0971 oz. Avoirdupois to equal 1 oz. Troy, which, at \$.75 per oz., would cost \$.8228 +; and $\$1 - \$.8228 + = .1772 +$, gain per oz. Troy, *Ans.*
10. 15 rd. 8 ft. = $255\frac{1}{2}$ ft.; 27 rd. 9 ft. = $454\frac{1}{2}$ ft.; $255\frac{1}{2} \times 454\frac{1}{2} = 116124\frac{3}{4}$ square feet; $116124\frac{3}{4} \div 43560 = 2.6658 + \text{ A.}$; $\$150 \times 2.6658 + = \$399.87 +$, *Ans.*
11. 10 hr. = 600 min. = 36000 sec.; and since 2 marks are made per sec., 2 times 36000, or 72000 marks, are made per day; and to make a million marks it will require as many days as 72000 is contained times in 1000000, which is $13\frac{3}{4}$ days, *Ans.*
12. $18 \times 1\frac{1}{2} \times 4 = 96$, the number of feet, board measure; 96 ft. = .096 of 1000 ft.; and $\$18 \times .096 = \1.728 .
13. $\$1689600.000 \div \$.10 = 16896000$, No. of ft. in length; $16896000 \div 5280 \text{ ft.} = 3200$, No. of miles, *Ans.*
14. 7 oz. 3 dr. 4 sc. = 3620 gr.; and $3620 \text{ gr.} \div 2 \text{ gr.} = 1810$, the number of pills, *Ans.*
15. $\$.20 \times 20 = \4.00 , the selling price;
 2.55, the cost;

 \$1.45, the gain per ream, *Ans.*

16. 13 lb. 7 oz. = $13\frac{7}{16}$ lb.; $\$.27\frac{1}{2} \times 13\frac{7}{16} = \3.695 ; and $\$3.695 \div \$.12 = 30.794$ lb., or 30 lb. 12.7+ oz., *Ans.*

17. $73\frac{3}{4} \times 6 \times 4 \div 128 = 13\frac{5\frac{3}{4}}{4}$ C., amount of first pile;
 $30 \times 7\frac{1}{8} \times 4 \div 128 = 6\frac{1\frac{1}{8}}{4}$ C., amount of second pile;
 $37 \times 3\frac{1}{2} \times 4 \div 128 = 4\frac{3}{4}$ C., amount of third pile;
 $24\frac{1\frac{1}{2}}{2}$ C., entire amount.

$\$4.60 \times 24\frac{1\frac{1}{2}}{2} = \$113.13 +$, entire value, *Ans.*

18. 4 reams 8 quires 12 sheets = 2124 sheets = 4248 half-sheets = 4.248 thousand; $\$6.50 \times 4.248 = \27.612 .

19. $\$18 \div \$6.85 = 2.627 +$, *Ans.*

20. $\frac{1}{2}$ of 327 bu. 3 pk. 5 qt. = $5246\frac{1}{2}$ qt.; 167 bu. 3 pk. = 5368 qt.; $5368 \text{ qt.} - 5246\frac{1}{2} \text{ qt.} = 121\frac{1}{2} \text{ qt.} = 3 \text{ bu. } 3 \text{ pk. } 1 \text{ qt. } 1 \text{ pt. too much, } \textit{Ans.}$

21. 20 fath. = 120 ft.; $62\frac{1}{2} \text{ lb.} \times 120 = 7500 \text{ lb.}$, the pressure on 1 ft. of surface; $7500 \times 9 = 67500 \text{ lb.}$, the pressure on a square yard, *Ans.*

ADDITION OF DENOMINATE NUMBERS.

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10. $12\frac{3}{4} \text{ yd.} = 12 \text{ yd. } 2 \text{ ft. } 3 \text{ in.}$

$8\frac{7}{8} \text{ yd.} = 8 \quad 2 \quad 7\frac{1}{2}$

$37\frac{1}{2} \text{ yd.} = 37 \quad 1 \quad 6$

$39\frac{1}{4} \text{ yd.} = 39 \quad 2 \quad 0$

$\quad \quad \quad 98 \quad 2 \quad 4\frac{1}{2}, \textit{ Ans.}$

$$\begin{array}{rcllcl}
 11. & \frac{1}{5} \text{ A.} & = & 32 \text{ sq. rd.} & 0 \text{ sq. yd.} & 0 \text{ sq. ft.} & 0 \text{ sq. in.} \\
 & \frac{3}{8} \text{ A.} & = & 60 & 0 & 0 & 0 \\
 & 129\frac{1}{4} \text{ sq. rd.} & = & 129 & 7 & 5 & 9 \\
 & 118\frac{1}{4} \text{ sq. rd.} & = & 118 & 7 & 5 & 9 \\
 & & & \hline
 & 2 \text{ A.} & & 19 & 15 & 1 & 18, \text{ Ans.}
 \end{array}$$

$$\begin{array}{rcllcl}
 12. & & & 24 \text{ gal.} & 2 \text{ qt.} & 3 \text{ pt.} \\
 & 45\frac{1}{8} \text{ gal.} & = & 45 & 0 & 1 \\
 & 39\frac{3}{8} \text{ gal.} & = & 39 & 1 & 1 \\
 & & & \hline
 & & & 109 & 1 & 1, \text{ Ans.}
 \end{array}$$

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$$\begin{array}{rcllcl}
 13. & 3 \text{ yr.} & 4 \text{ mo.} & 18 \text{ da.,} & \text{age of James;} & \\
 & 2 & 8 & 6 & & \\
 & \hline
 & 6 & 0 & 24, & \text{age of Henry;} & \\
 & 7 & 10 & 14 & & \\
 & \hline
 & 13 & 11 & 18, & \text{age of William;} & \\
 & 1 & 8 & & & \\
 & \hline
 & 15 & 7 & 18, & \text{age of Herbert,} & \text{Ans.}
 \end{array}$$

$$\begin{array}{rcllcl}
 14. & 20\frac{1}{8} \text{ cwt.} & = & 20 \text{ cwt.} & 33 \text{ lb.} & 5\frac{1}{8} \text{ oz.} \\
 & 16\frac{1}{4} \text{ T.} & = & 16 \text{ T.} & 2 & 85 & 11\frac{3}{4} \\
 & 17\frac{1}{8} \text{ lb.} & = & & 17 & 2 \\
 & & & & 19 & 18 & 7 \\
 & & & & & 15 & 8 \\
 & & & & & 2 & 7 & 5 \\
 & & & & & & & 6\frac{3}{4} \\
 & \frac{3}{4} \text{ lb.} & = & & & & & 17\frac{1}{8} \\
 & \frac{5}{8} \text{ T.} & = & 11 & 11 & 4 \\
 & & & \hline
 & & & 22 & 17 & 46 & 32\frac{5}{8}, \text{ Ans.}
 \end{array}$$

SUBTRACTION OF DENOMINATE NUMBERS.

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9. $\frac{3}{4}$ A. = 120 sq. rd. 0 sq. ft. 0 sq. in.

$$\begin{array}{r} 72 \quad 160 \quad 39 \\ \hline 47 \quad 111(\frac{1}{4}) \quad 105 \end{array}$$

Or since $\frac{1}{4}$ sq. ft. = 36 sq. in., the answer may be written : 47 sq. rd. 111 sq. ft. 141 sq. in.; or since 111 sq. ft. = 12 sq. yd. 3 sq. ft., the difference may be expressed as 47 sq. rd. 12 sq. yd. 3 sq. ft. 141 sq. in., *Ans.*

10. £384 6s. 5d. 2 far.

$$\begin{array}{r} 297 \quad 9 \quad 8 \quad 3 \\ \hline \end{array}$$

86 16 8 3, *Ans.*

11. $97\frac{1}{2}$ A. = 97 A. 133sq.rd. 10sq.yd. 0sq.ft. 108sq.in.

$$\left. \begin{array}{l} 38 \text{ A.} \\ 39\frac{1}{4} \text{ sq.rd.} \end{array} \right\} = \begin{array}{r} 38 \quad 39 \quad 7 \quad 5 \quad 9 \end{array}$$

$$\begin{array}{r} 136 \quad 12 \quad 17 \quad 5 \quad 117 \\ \hline \end{array}$$

285 A. 0sq.rd. 0sq.yd. 0sq.ft. 0sq.in.

$$\begin{array}{r} 136 \quad 12 \quad 17 \quad 5 \quad 117 \\ \hline \end{array}$$

$$\begin{array}{r} 148 \quad 147 \quad 12(\frac{1}{4}) \quad 3 \quad 27 \\ \hline \end{array}$$

$\frac{1}{4}$ sq. yd. = $\begin{array}{r} 2 \quad 36 \\ \hline \end{array}$

$$\begin{array}{r} 148 \quad 147 \quad 12 \quad 5 \quad 63, \text{Ans.} \end{array}$$

12. 9R. 18qu. 15sh. 14. 1851yr. 3mo. 15da.

$$3\frac{1}{2} \text{ R.} = \begin{array}{r} 3 \quad 8 \quad 8 \\ \hline \end{array}$$

$$\begin{array}{r} 1843 \quad 1 \quad 3 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \quad 10 \quad 7 \end{array}$$

$$\begin{array}{r} 8 \quad 2 \quad 12, \text{Ans.} \end{array}$$

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- | | |
|---|--|
| <p>15. 1869 yr. 12 mo. 15 da. $\begin{array}{r} 1803 \quad 4 \quad 2 \\ \hline 66 \quad 8 \quad 13, \text{ Ans.} \end{array}$</p> | <p>16. 1871 yr. 1 mo. 5 da. $\begin{array}{r} 1860 \quad 5 \quad 15 \\ \hline 10 \quad 7 \quad 20, \text{ Ans.} \end{array}$</p> |
| <p>17. 1837 yr. 12 mo. 8 da. $\begin{array}{r} 3 \quad 2 \quad 5 \\ \hline 1841 \quad 2 \quad 13 \end{array}$ Feb. 13, 1841, <i>Ans.</i></p> | |
| <p>19. 1865 yr. 4 mo. 9 da. $\begin{array}{r} 1861 \quad 4 \quad 11 \\ \hline 3 \quad 11 \quad 28, \text{ Ans.} \end{array}$</p> | <p>20. 1876 yr. 10 mo. 10 da. $\begin{array}{r} 1871 \quad 7 \quad 9 \\ \hline 5 \quad 3 \quad 1, \text{ Ans.} \end{array}$</p> |

MULTIPLICATION OF DENOMINATE NUMBERS.

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5. The farm consists of 7 times 18 A. 25 sq. rd., which is 127 A. 15 sq. rd., *Ans.*
6. Since the field is square the sides are of equal length, and the entire length of the fence will be 4 times 28 rd. 5 yd. $2\frac{1}{2}$ ft., which is 116 rd. 1 yd. 1 ft., *Ans.*
7. The entire quantity of wood will be 7 times 13 C. 7 cd. ft. 24 cu. ft., which is 98 C. 3 cd. ft. 8 cu. ft., *Ans.*
8. The cost will be $14\frac{1}{2}$ times £2 5s. 6d. $\frac{1}{2}$ of £2 5s. 6d. is £1 2s. 9d., and 14 times £2 5s. 6d. is £31 17s. The sum of £1 2s. 9d. and £31 17s. is £32 19s. 9d., *Ans.*

9. The whole quantity of potatoes was 4 times 27 bu. 3 pk., which was 111 bu. $\$.45 \times 111 = \49.95 , *Ans.*

DIVISION OF DENOMINATE NUMBERS.

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3. $5 \overline{) 427 \text{ A. } 131 \text{ sq. rd. } 0 \text{ sq. yd.}}$

$$\begin{array}{r} 85 \quad 90 \quad 6\frac{1}{2} \end{array}$$

$\frac{1}{20}$ sq. yd. = $64\frac{2}{3}$ sq. in. Therefore the result is 85 A. 90 sq. rd. 6 sq. yd. $64\frac{2}{3}$ sq. in., *Ans.*

4. $4 \overline{) 315 \text{ gal. } 3 \text{ qt.}}$

$$\begin{array}{r} 78 \quad 3\frac{1}{2} \end{array}$$

$\frac{3}{4}$ qt. = 1 pt. 2 gi. Therefore the result is 78 gal. 3 qt. 1 pt. 2 gi., *Ans.*

5. $9 \overline{) 16 \text{ T. } 1300 \text{ lb.}}$

$$\begin{array}{r} 1 \quad 1700, \text{ Ans.} \end{array}$$

6. $3 \overline{) 8 \text{ C. } 100 \text{ cu. ft.}}$

$$\begin{array}{r} 2 \quad 118\frac{2}{3}, \text{ Ans.} \end{array}$$

7. $10 \overline{) £31 \text{ 5s. } 8d.}}$

$$\begin{array}{r} 3 \quad 2 \quad 6\frac{1}{2}, \text{ Ans.} \end{array}$$

9. 2 qt. 1 pt. = 5 pt.; 31 gal. = 248 pt.; $248 \text{ pt.} \div 5 \text{ pt.} = 49\frac{3}{5}$. Therefore he must dip 50 times., *Ans.*

10. 23 mi. 160 rd. 4 yd. 2 ft. = 124094 ft.; 100 mi. = 528000 ft. Therefore, $528000 \div 124094 = 4\frac{81624}{124094}$ da. = 4 da. 6 hr. 6 min. 58 + sec., *Ans.*

11. $13 \overline{) 300}$ mi.

$23\frac{1}{8}$ mi. = 23 mi. 24 rd. 10 ft. $1\frac{1}{8}$ in., *Ans.*

12. 2 cwt. 35 lb. = 235 lb.; 3 T. 4 cwt. 18 lb. = 6418 lb.
Therefore, $6418 \div 235 = 27\frac{73}{235}$, the number of barrels.

13. 2 oz. 10 pwt. = 50 pwt.; 13 lb. 7 oz. 15 pwt. = 3265 pwt. Therefore, $3265 \div 50 = 65$, the number of spoons, and 25 pwt. or 1 oz. 5 pwt. remaining. *Ans.*

14. Since the boards were 8 in. wide, they were 4 pickets wide, and they were as many pickets in length as 2 ft. 4 in. is contained in 11 ft. 8 in., which is 5 times. Therefore, $4 \times 5 \times 5 = 100$, number of pickets. *Ans.*

LONGITUDE AND TIME.

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3. $15 \overline{) 32^\circ \quad 18' \quad 24''}$

2 hr. 9 min. $13\frac{2}{5}$ sec., *Ans.*

4. Since the difference in time is 3 hr. 9 min. 7 sec., the difference in longitude is 15 times as many degrees, etc., which is $47^\circ 16' 45''$. Therefore the longitude of San Francisco is $75^\circ 10' + 47^\circ 16' 45''$, which is $122^\circ 26' 45''$ west, *Ans.*

5. Since one is east longitude and the other is west longitude, their difference in longitude is the sum of $74^\circ 3'$ and $2^\circ 20'$, which is $76^\circ 23'$; and the difference in time is $\frac{1}{15}$ as many hours, etc.: 5 hr. 5 min. 32 sec.

6. The difference in time is $\frac{1}{15}$ as many hours, etc., as there are degrees, etc.: $\frac{1}{15}$ of 77 is 5 hr. 8 min., *Ans.*
7. The difference in degrees is $2^{\circ} 57'$, and the difference in time is $\frac{1}{15}$ as many hours, etc., as there are degrees, etc., which is 11 min. 48 sec. And since New York is east of Washington, the time at New York is 11 min. 48 sec. past 12, *Ans.*
8. Since the difference in time is 1 hr. 5 min. 8 sec., the difference in longitude will be 15 times as many degrees, etc., which is $16^{\circ} 17'$, *Ans.*
9. The difference in longitude between the places, counting from Pekin west to Washington, is $193^{\circ} 27' 30''$, and therefore the difference in time is 12 hr. 53 min. 50 sec. Therefore, when it was noon at Washington, it was 53 min. 50 sec. past midnight, on January 2d, at Pekin.
10. 15 times 1 hr. 11 min. = $17^{\circ} 45'$. And since his time was too slow, he must have been traveling toward the sun; that is, toward the East, *Ans.*

METRIC MEASURES.

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8. Since $2.47114 \text{ acres} = 100 \text{ ares}$, $1 \text{ acre} = 100 \text{ ares} \div 2.47114 = 40.4671 + \text{ares}$, *Ans.*
9. $1 \text{ hectolitre} = 2.8372 \text{ bu.}$; $\frac{1}{3} \text{ hectolitre} = .9457$, or nearly a bushel, *Ans.*

10. Since there are 10 decimetres in a metre, in 586.431 metres there are 10 times 586.431, or 5864.31 decimetres, *Ans.*
11. $\$.22 \times 324.16 = \71.315 , *Ans.*
12. $\$2.15 \times 38 = \81.70 , the cost. Since 1 dekalitre = 2.6417 gal., $38 \text{ gal.} \div 2.6417 = 14.38$ dekalitres; $\$5 \times 14.38 = \71.90 , the selling price; $\$81.70 - \$71.90 = \$9.80$, the entire loss; $\$9.80 \div 38 = \$.257 +$, per gal., *Ans.*
13. Since a metre is 39.37079 in., at the price per metre 1 in. = $\$3 \div 39.37079$, and 36 in. or 1 yd. = 36 times that result, which is $\$2.743$. And $\$2.90 - \$2.743 = \$.157$, the difference per yard in favor of buying by the metre, *Ans.*
14. $M. 4.2 \times M. 3.8 = M. 15.96$, *Ans.*
15. $M. 3.5 \times M. 3 = M. 10.5$; $S. 12 \div 10.5 = M. 1\frac{1}{3}$, *Ans.*
16. $\$2 \times 100 = \200 , the cost;
 $39.37079 \times 100 \div 36 = 109.363$, No. of yd. in 100 M.;
 $\$2.25 \times 109.363 = \246.067 , the selling price;
 $\$246.067 - \$200 = \$46.067$, the gain, *Ans.*
17. $\$2.50 \times 1400 = \3500 , *Ans.*
18. Since a kilogramme, or *kilo*, is 2.20462 lb., there will be as many *kilos* in 196 lb. as 2.20462 is contained times in 196, which is $88.904 +$ kilos, *Ans.*
19. $1000 \times 180 = 180000$ sq. metres;
 $180000 \text{ sq. metres} \div 100 = 1800$ ares;
 $1800 \text{ ares} \div 100 = 18$ hectares, *Ans.*
 $\$250 \times 18 = \4500 , *Ans.*

20. $5 \times 5 \times 2.5 = 62.5$ cu. metres. Since a litre is a cube whose edge is $\frac{1}{10}$ of a metre, a cu. metre will contain 1000 litres, and 62.5 cu. metres 62500 litres, or 625 hectolitres, *Ans.*
21. $5.2 \times 3.2 = 16.64$ sq. metres, the area of one side;
 $16.64 \times 2 = 33.28$ sq. metres, the area of two sides;
 $4.5 \times 3.2 = 14.40$ sq. metres, the area of another side;
 $14.40 \times 2 = 28.80$ sq. metres, area of other two sides;
 $5.2 \times 4.5 = 23.40$ sq. metres, the area of ceiling;
 $33.28 + 28.80 + 23.40 = 85.48$ sq. metres, entire area;
 $\$.35 \times 85.48 = \$29.918 +$, *Ans.*
22. Since a kilo is 2.20462 lb., $\$.23 \div 2.20462$ will give the price per pound, which is \$.104326, or \$208.652 per ton. At \$.11 per pound, a ton would sell for \$220. Therefore, $\$220 - \$208.652 = \$11.348$, the difference in favor of 11 cents per pound, *Ans.*
23. $\$.18\frac{1}{4} \times 200 = \37.50 , amt received for the molasses;
 $26.417 \text{ gal.} \times 2 = 52.834 \text{ gal.}$, No. gal. in 2 hectolitres;
 $\$.90 \times 52.834 = \47.55 ;
 $\$47.55 - \$37.50 = \$10.05$, the difference in favor of selling at 90 cents per gallon, *Ans.*

PERCENTAGE.

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17. $100\% - 33\frac{1}{3}\% = 66\frac{2}{3}\%$; $66\frac{2}{3}\%$, or $.66\frac{2}{3}$, or $\frac{2}{3}$, of 450 sheep = 300 sheep, *Ans.*
18. $100\% - 85\% = 15\%$; 15% , or $.15$, or $\frac{3}{20}$, of \$2000 is \$300.

19. $37\frac{1}{2}\%$, or $.37\frac{1}{2}$, or $\frac{3}{8}$, of 816 bu. = 306 bu.; $\$1.56 \times 306 = \477.36 ; 816 bu. — 306 bu. = 510 bu.; $\$1.60 \times 510 = \816 . Therefore, $\$816 + \$477.36 = \$1293.36$, amount of his sales of wheat, *Ans.*
20. $100\% - 5\% = 95\%$; 95% , or .95, of $\$318.57$ is $\$302.64$.
21. $100\% + 25\% = 125\%$; 125% , or 1.25, or $\frac{5}{4}$, of $\$30000 = \37500 , *Ans.*
22. $12\frac{1}{2}\%$, or $.12\frac{1}{2}$, or $\frac{1}{8}$, of $\$3000 = \375 , the loss;
 $\$3000 - \$375 = \$2625$, *Ans.*
23. $15\% + 27\% = 42\%$, invested in bank-stock and bonds;
 $100\% - 42\% = 58\%$, the part invested in a mill;
 58% , or .58 of $\$40000$ is $\$23200$, *Ans.*
24. 24% of $\$18500 = \4440 ;
 $\$18500 + \$4440 = \$22940$, the property of the elder;
 $33\frac{1}{3}\%$, or $\frac{1}{3}$, of $\$18500 = \$6166.66\frac{2}{3}$, loss of the younger;
 $\$18500 - \$6166.66\frac{2}{3} = \$12333.33\frac{1}{3}$, younger's prop'ty.

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22. He sold $\frac{21}{100}$, or $\frac{7}{10}$, or $.38\frac{3}{4}$, or $38\frac{3}{4}\%$, *Ans.*
23. He spends $\frac{188}{100}$, or $\frac{8}{5}$, or $.88\frac{3}{4}$, or $88\frac{3}{4}\%$; therefore he has left $100\% - 88\frac{3}{4}\%$, or $11\frac{1}{4}\%$, *Ans.*
24. Since he gained \$.25 per pound, he gained $\frac{2}{5}$, or $\frac{1}{3}$, or $33\frac{1}{3}\%$, of the cost, *Ans.*
25. 50 bu. are $\frac{50}{30000}$, or $\frac{1}{600}$, or $\frac{1}{6}\%$, of 30000 bu., *Ans.*
26. Since he gains \$1.50 on each hat, he gains $\frac{150}{1000}$, or $\frac{3}{11}$, or $27\frac{3}{11}\%$, of the cost, *Ans.*
27. He receives $\frac{60}{100}$, or $\frac{14}{100}$, or $1\frac{1}{2}\%$, of the sale, *Ans.*

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28. The sum paid for insurance is $\frac{120}{10000}$, or $\frac{3}{250}$, or $1\frac{1}{5}\%$, of the value of the cargo, *Ans.*
29. The eldest received $\frac{1}{4}$, or $\frac{25}{100}$, or 25% , of the whole; the next, $\frac{1}{5}$, or $\frac{20}{100}$, or 20% , of the whole; and since the sons had $25\% + 20\%$, or 45% , the daughters had each $\frac{1}{3}$ of the remaining 55% , which is $18\frac{1}{3}\%$, *Ans.*

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17. Since 75% , or $\frac{3}{4}$, of whole number is 275 bbl., the whole number is 4 times $\frac{1}{4}$ of 275, or $366\frac{2}{3}$ bbl., *Ans.*
18. Since 25% , or $\frac{1}{4}$, of the value of the mill is \$3750, the whole value is 4 times \$3750, or \$15000, *Ans.*
19. Since he sold 25% , or $\frac{1}{4}$, of his share, he sold $\frac{1}{4}$ of 40% , which is 10% , or $\frac{1}{10}$, of the whole; and since $\frac{1}{10}$ of the value of the foundry is \$10000, the whole value is 10 times that sum, or \$100000, *Ans.*
20. Since he had 90% left, the part sold must be 10% , or $\frac{1}{10}$, of the whole. Therefore, 110 A. 43 sq. rd. = $\frac{1}{10}$ of the whole, and the whole is 10 times that sum, or 1102 A. 110 sq. rd., *Ans.*
21. $\frac{1}{3}$ of \$3000 = \$1000, which is $62\frac{1}{2}\%$, or $\frac{5}{8}$, of the cost of house and barn. Therefore the house and barn will cost 8 times $\frac{1}{8}$ of \$1000, which is \$1600, *Ans.*
22. \$80 is $8\frac{1}{2}\%$ of one-half the amount due, or $4\frac{1}{4}\%$ of the amount due. Therefore the amount due is equal to $\$80 \div 4\frac{1}{4} \times 100$, which is \$1882 $\frac{6}{7}$, *Ans.*

23. $\$1.60 \times 4500 = \7200 , amount received for the wheat; $\$7200$ was 90%, or $\frac{9}{10}$, of the cost, which was 10 times $\frac{1}{9}$ of $\$7200$, which is $\$8000$, *Ans.*
24. Since $\$8000$ is 40%, or $\frac{2}{5}$, of the amount paid for the lot, the cost of the lot was 5 times $\frac{1}{2}$ of $\$8000$, which is $\$20000$, *Ans.*
25. 75%, or $\frac{3}{4}$, of $\$600$ is $\$450$; and $\$450$ is $33\frac{1}{3}\%$, or $\frac{1}{3}$, of one-half his income, or $\frac{1}{6}$ of his income. Therefore his income is 6 times $\$450$, which is $\$2700$, *Ans.*
26. Since he owned $\frac{1}{3}$ of the vessel, and sold 25%, or $\frac{1}{4}$, of his share, he sold $\frac{1}{12}$ of the vessel. Since he received $\$3350.50$ for $\frac{1}{12}$ of the vessel, at that rate the vessel would be worth 12 times $\$3350.50$, or $\$40206$, *Ans.*
27. Since $\$7500000$ is $37\frac{1}{2}\%$, or $\frac{3}{8}$, of the estimated loss, the estimated loss is 8 times $\frac{1}{3}$ of $\$7500000$, which is $\$20000000$, *Ans.*
28. Since 25% of $\frac{1}{3}$ of 60 $= \frac{1}{4}$ of $\frac{1}{3}$ of 60, which is 5, and 75% of $\frac{1}{3}$ of the number is $\frac{3}{4}$ of $\frac{1}{3}$ of the number, which is $\frac{1}{4}$ of the number, 5 is $\frac{1}{4}$ of the number. Therefore the number is 4 times 5, or 20, *Ans.*
29. $\frac{2}{3}$ of 40% of 100 $= 26\frac{2}{3}$; 5% of 10 times $\frac{1}{4}$ of the number $= \frac{1}{8}$ of the number. Therefore, $26\frac{2}{3}$ is $\frac{1}{8}$ of the number, which is $213\frac{1}{3}$, *Ans.*

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13. $\$15400 \div 1.10 = \14000 , value of his property, *Ans.*
14. $\$345 \div 1.15 = \300 , the cost of the horse, *Ans.*

15. $\$1950 \div 1.30 = \1500 , the previous salary, *Ans.*
16. $\$3750 \div 1.25 = \3000 , one-half the cost of the house.
Therefore the house cost 2 times \$3000, or \$6000, *Ans.*
17. $872 \div 1.09 = 800$, the attendance during 1875, *Ans.*

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14. Since he paid out 75% of his salary, he had but 25%, or $\frac{1}{4}$, of it left. Therefore, \$450 is $\frac{1}{4}$ of his salary, and his salary is 4 times \$450, which is \$1800, *Ans.*
15. Since he sold 30% of his wheat, he had 70%, or $\frac{7}{10}$, of it left. Therefore, 350 bu. is $\frac{7}{10}$ of the entire quantity, which is 500 bu., *Ans.*
16. Since he sold it at 30% less than his asking price, he sold it for 70% of his asking price. Therefore, 70% of his asking price is \$29.24; and $\$29.24 \div .70 = \$41.77\frac{1}{2}$, the asking price, *Ans.*
17. If it lost 15% of its men, it had 85% left. Therefore, 85% of the number is 527; and $527 \div .85 = 620$, the entire number, *Ans.*
18. Since he lost, during 1876, 10% of what he had left after his losses in 1875, \$40500 is 90% of the amount at the end of 1875; and $\$40500 \div .90 = \45000 , the amount he had at the end of 1875. Since he lost 10% of his money during 1875, \$45000 must be 90% of the amount of his money; and $\$45000 \div .90 = \50000 , the amount of his money, *Ans.*

19. Since his profits were 23% less than in 1875, \$10318 is 77% of the profits in 1875. Therefore, $\$10318 \div .77 = \13400 , the profit in 1875, *Ans.*

COMPOUND INTEREST.**Page 226.**

2. \$315.00, Principal for 1st year;
 18.90, Interest for 1st year;

 \$333.90, Principal for 2d year;
 20.03, Interest for 2d year;

 \$353.93, Principal for 3d year;
 10.62, Interest for 6 mo.;

 \$364.55, Amount for 2 yr. 6 mo.;
 315.00, Given principal;

 \$ 49.55, Compound interest, *Ans.*
3. \$324.18, Principal for 1st year;
 22.69, Interest for 1st year;

 \$346.87, Principal for 2d year;
 24.28, Interest for 2d year;

 \$371.15, Principal for 3d year;
 25.98, Interest for 3d year;

 \$397.13, Principal for 4th year;
 11.58, Interest for 5 mo.;

 \$408.71, Amount for 3 yr. 5 mo., *Ans.*

4. \$525.75, Principal for 1st year;
 31.55, Interest for 1st year;

 \$557.30, Principal for 2d year;
 33.44, Interest for 2d year;

 \$590.74, Principal for 3d year;
 35.44, Interest for 3d year;

 \$626.18, Principal for 4th year;
 12.52, Interest for 4 mo.;

 \$638.70, Amount for 3 yr. 4 mo.;
 525.75, Given principal;

 \$112.95, Compound interest, *Ans.*
6. \$1.191016, Amount of \$1 for 3 yr.;
 .041685, Interest for 7 mo.;

 \$1.232701, Amount of \$1 for 3 yr. 7 mo.;
 600.50,

 \$740.23, Amount of principal for 3 yr. 7 mo.;
 600.50, Given principal;

 \$139.73, Compound interest, *Ans.*
7. \$1.1449, Amount of \$1 for 2 yr.;
 .026714, Interest for 4 mo.;

 \$1.171614, Amount of \$1 for 2 yr. 4 mo.;
 318.25

 \$372.86, Amount of principal for 2 yr. 4 mo.;
 318.25, Given principal;

 \$ 54.61, Compound interest, *Ans.*

8. \$1.191016, Amount of \$1 for 3 yr.;
 .013895, Interest for 2 mo. 10 da.;

\$1.204911, Amount of \$1 for 3 yr. 2 mo. 10 da.;
 412.08

\$496.51, Amount of principal for 3 yr. 2 mo. 10 da.;
 412.08, Given principal;

\$ 84.43, Compound interest, *Ans.*

9. \$1.1664, Amount of \$1 for 2 yr.;
 .042768, Interest for 5 mo. 15 da.;

\$1.209168, Amount of \$1 for 2 yr. 5 mo. 15 da.;
 310.24

\$375.13, Amount of principal for 2 yr. 5 mo. 15 da.;
 310.24, Given principal;

\$ 64.89, Compound interest, *Ans.*

10. \$328.00, Principal;
 \$ 59.31, Simple interest for given time at 7%;

\$1.1236, Am't of \$1 for 2 yr., comp. int.;
 .039326, Int. on that amount for 7 mo.;

\$1.162926, Am't of \$1, 2 yr. 7 mo., comp. int.;
 328

\$381.44, Am't for 2 yr. 7 mo., comp. int.;
 328

\$ 53.44, Compound interest;

\$59.31 — \$53.44 = \$5.87, *Ans.*

11. Since the interest is compounded semi-annually, there are 7 semi-annual periods for reckoning interest, which increase the principal by 3% of itself each time. Therefore the compound interest for $3\frac{1}{2}$ yr. semi-annually at 6% is the same as compound interest for 7 yr. at 3%.

\$1.229874, Amount of \$1 for 7 yr. at 3%, or $3\frac{1}{2}$ yr.
 300 at 6% semi-annually.

 \$368.96, Amount due, *Ans.*

ANNUAL INTEREST.

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2. Int. of \$350 for 4 yr. at 8% = \$112;
 Int. of \$350 for 1 yr. at 8% = \$28;
 Int. of \$28 for 3 yr. + 2 yr. + 1 yr., or 6 yr., at 8%
 = \$13.44;
 \$350 + \$112 + \$13.44 = \$475.44, Amount due, *Ans.*
3. 1877 yr. 4 mo. 15 da.

| | | |
|------|---|----|
| 1873 | 1 | 1 |
| 4 | 3 | 14 |

 Int. of \$750 for 4 yr. 3 mo. 14 da. at 6% = \$193;
 Int. of \$750 for 1 yr. at 6% = \$45;
 Int. of \$45 for 3 yr. 3 mo. 14 da. + 2 yr. 3 mo. 14
 da. + 1 yr. 3 mo. 14 da. + 3 mo. 14 da., or 7 yr.
 1 mo. 26 da., at 6% = \$19.32;
 \$750 + \$193 + \$19.32 = \$962.32, Amount due, *Ans.*

PARTIAL PAYMENTS.**Page 229.**

| | |
|------------------------------------|------------------------|
| 1. Principal | \$850. |
| Int. to Nov. 15, 1876 | 51.887 |
| Am't of principal Nov. 15, 1876 . | \$901.887 |
| First payment | \$200. |
| Int. on payment to Nov. 15, 1876 . | 8.361 |
| Second payment | 255.000 |
| Int. on payment to Nov. 15, 1876 . | 2.975 |
| Am't of payments Nov. 15, 1876 . | \$466.336 |
| Am't due Nov. 15, 1876 | \$435.551, Ana. |
| 2. Principal | \$1800. |
| Int. to May 15, 1876 | 126. |
| Am't of principal May 15, 1876 . | \$1926. |
| First payment | \$300. |
| Int. on payment to May 15, 1876 . | 13.708 |
| Second payment | 200. |
| Int. on payment to May 15, 1876 . | 4.549 |
| Third payment | 1000. |
| Int. on payment to May 15, 1876 . | 4.861 |
| Am't of payments May 15, 1876 . | \$1523.118 |
| Am't due May 15, 1876 | \$402.882, Ana. |

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|---------------------------------|-----------------------|
| 3. Principal | \$585.25 |
| Int. to Nov. 3, 1876 | 27.31 |
| <hr/> | |
| Amount at maturity | 612.56 |
| First payment | \$325. |
| Int. to Nov. 3, 1876 | 9.163 |
| Second payment | 84.30 |
| Int. to Nov. 3, 1876 | 1.458 |
| Third payment | 100. |
| Int. to Nov. 3, 1876 | 1.186 |
| <hr/> | |
| Am't of payment at maturity . . | \$521.107 |
| <hr/> | |
| Am't due Nov. 3, 1876 | \$91.453, <i>Ans.</i> |
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|----------------------------------|-----------|
| 2. Principal | \$2500.00 |
| Int. to Sept. 15, 1871 | 27.083 |
| <hr/> | |
| Amount | 2527.083 |
| First payment | 150.000 |
| <hr/> | |
| New principal | 2377.083 |
| Int. to Nov. 12, 1871 | 22.582 |
| <hr/> | |
| Amount | 2399.665 |
| Second payment | 300.000 |
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| New principal | 2099.665 |
| Int. to Dec. 1, 1871 | 6.648 |
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| Amount | 2106.313 |

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|--------------------------------------|------------------------|
| (<i>Brought forward</i>) | \$2106.313 |
| Third payment | 100.000 |
| New principal | 2006.313 |
| Int. to April 3, 1872 | 40.795 |
| Amount | 2047.108 |
| Fourth payment | 325.000 |
| New principal | 1722.108 |
| Int. to May 15, 1872 | 12.054 |
| Amount | 1734.162 |
| Fifth payment | 275.000 |
| New principal | 1459.162 |
| Int. to Sept. 20, 1872 | 30.399 |
| Amount | 1489.561 |
| Sixth payment | 1000.000 |
| New principal | 489.561 |
| Int. to Jan. 1, 1873 | 8.240 |
| Amount due Jan. 1, 1873 | <u>\$497.801, Ans.</u> |
| 3. Principal | \$2150.00 |
| Int. to Dec. 15, 1873 | 40.61 |
| Amount | 2190.61 |
| First payment | 75.00 |
| New principal | 2115.61 |

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|---|-------------------------------|
| (<i>Brought forward</i>) | \$2115.61 |
| Int. to Feb. 4, 1874 | 23.036 |
| Amount | 2138.646 |
| Second payment | 200.000 |
| New principal | 1938.646 |
| Int. to April 3, 1874 | 25.417 |
| Amount | 1964.063 |
| Third payment | 150.000 |
| New principal | 1814.063 |
| Int. to July 1, 1874 | 35.475 |
| Amount | 1849.538 |
| Fourth payment | 500.000 |
| New principal | 1349.538 |
| Int. to Dec. 16, 1874 | 49.483 |
| Amount | 1399.021 |
| Fifth payment | 1000.000 |
| New principal | 399.021 |
| Int. to maturity | 40.256 |
| Amount due at maturity | \$439.277, <i>Ans.</i> |
| 4. Principal | \$6725.00 |
| Int. to May 5, 1875 | 95.27 |
| Amount | 6820.27 |

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|--|------------------------|
| (<i>Brought forward</i>) | \$6820.27 |
| First payment | 275.00 |
| <hr/> | |
| New principal | 6545.27 |
| Interest to Aug. 15, 1875 | 109.09 |
| Second pay't (less than int. due) . | \$50 |
| Int. on previous prin. from Aug. 15, 1875, to Nov. 12, 1875 . . . | 94.904 |
| <hr/> | |
| Amount | 6749.264 |
| Sum of second and third payments . | 1050.000 |
| <hr/> | |
| New principal | 5699.264 |
| Int. to Jan. 3, 1876 | 48.443 |
| <hr/> | |
| Amount | 5747.707 |
| Fourth payment | 184.25 |
| <hr/> | |
| New principal | 5563.457 |
| Fifth pay't (less than int. due) \$ | 84.10 |
| Int. on same prin. from Sept. 13, 1876, to Dec. 23, 1876 . . . | 92.724 |
| <hr/> | |
| Amount | 5887.990 |
| Int. to Sept. 13, 1876 | 231.809 |
| Sum of fifth and sixth payments . . | 1084.10 |
| <hr/> | |
| New principal | 4803.89 |
| Int. to Feb. 10, 1877 | 37.63 |
| <hr/> | |
| Amount due Feb. 10, 1877 | \$4841.52, <i>Ans.</i> |
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|---|--------------------------------|
| 5. Principal | \$5825.00 |
| Int. to May 15, 1871 | 519.07 |
| Amount | 6344.07 |
| First payment | 728.50 |
| New principal | 5615.57 |
| Int. to April 8, 1872 | 403.073 |
| Amount | 6018.643 |
| Second payment | 1000.000 |
| New principal | 5018.643 |
| Int. to Dec. 12, 1872 | 272.122 |
| Third pay't (less than int. due) . | \$125 |
| Int. on same prin. from Dec. 12, 1872, to July 9, 1873 | 230.857 |
| Amount | 5521.622 |
| Sum of third and fourth payments . | 1105.000 |
| New principal | 4416.622 |
| Int. to June 12, 1874 | 326.83 |
| Amount | 4743.452 |
| Fifth payment | 1000.000 |
| New principal | 3743.452 |
| Int. to April 4, 1875 | 242.90 |
| Amount due April 4, 1875 | <u><u>\$3986.352, Ans.</u></u> |

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|--|-----------------------|
| 6. Principal | \$895.75 |
| Int. to Jan. 10, 1873 | 26.126 |
| First pay't (less than int. due) . | \$25 |
| Int. on same prin. from Jan. 10, 1873, to Oct. 12, 1873 | 67.678 |
| Amount | 989.554 |
| Sum of first and second payments . | 225.000 |
| New principal | 764.554 |
| Int. to Jan. 18, 1874 | 20.388 |
| Amount | 784.942 |
| Third payment | 75.000 |
| New principal | \$709.942 |
| Int. to March 25, 1874 | 13.212 |
| Amount | 723.154 |
| Fourth payment | 187.500 |
| New principal | 535.654 |
| Int. to Jan. 1, 1875 | 41.066 |
| Amount | 576.720 |
| Fifth payment | 375.000 |
| New principal | 201.72 |
| Int. to Nov. 15, 1875 | 17.59 |
| Amount due Nov. 15, 1875 | \$219.31, <i>Ans.</i> |

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|---------------------------------|----------|
| 7. Principal | \$580.00 |
| Int. to April 1, 1875 | 7.25 |
| | <hr/> |
| Amount | 587.25 |
| First payment | 85.00 |
| | <hr/> |
| New principal | 502.25 |
| Int. to July 1, 1875 | 6.278 |
| | <hr/> |
| Amount | 508.528 |
| Second payment | 85.00 |
| | <hr/> |
| New principal | 423.528 |
| Int. to Oct. 1, 1875 | 5.294 |
| | <hr/> |
| Amount | 428.822 |
| Third payment | 85.000 |
| | <hr/> |
| New principal | 343.822 |
| Int. to Jan. 1, 1876 | 4.297 |
| | <hr/> |
| Amount | 348.119 |
| Fourth payment | 85.000 |
| | <hr/> |
| New principal | 263.119 |
| Int. to April 1, 1876 | 3.288 |
| | <hr/> |
| Amount | 266.407 |
| Fifth payment | 85.000 |
| | <hr/> |
| New principal | 181.407 |
| Int. to July 1, 1876 | 2.267 |
| | <hr/> |
| Amount | 183.674 |

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|--------------------------------------|------------------------------|
| (<i>Brought forward</i>) | \$183.674 |
| Sixth payment | 85.000 |
| New principal | 98.674 |
| Int. to Oct. 1, 1876 | 1.232 |
| Amount | 99.906 |
| Seventh payment | 85.000 |
| New principal | 14.906 |
| Int. to Jan. 1, 1877 | .18 |
| Amount due at maturity | <u>\$15.086, <i>Ans.</i></u> |

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|--|-------------|
| 8. Principal | \$10000.000 |
| Int. to Feb. 23, 1876 | 157.777 |
| Amount | 10157.777 |
| First payment | 750.000 |
| New principal | 9407.777 |
| Int. to July 17, 1876 | 301.048 |
| 2d pay't (less than int. due) \$108.25 | |
| Int. on same prin. from July 17, 1876, to Nov. 23, 1876 | 263.418 |
| Amount | 9972.243 |
| Sum of second and third payments | 3108.25 |
| New principal | 6863.993 |

PARTIAL PAYMENTS.

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|------------------------------------|--------------------------------|
| (<i>Brought forward</i>) | \$6863.993 |
| Int. to Jan. 18. 1877 | 83.893 |
| <hr/> | |
| Amount | 6947.886 |
| Third payment | 4000.000 |
| <hr/> | |
| New principal | 2947.886 |
| Int. to May 12, 1877 | 74.679 |
| <hr/> | |
| Amount due May 12, 1877 . . . | <u><u>\$3022.565, Ans.</u></u> |
| | |
| 9. Principal | \$3124.75 |
| Int. to Dec. 23, 1874 | 213.87 |
| <hr/> | |
| Amount | 3338.62 |
| First payment | 985.00 |
| <hr/> | |
| New principal | 2353.62 |
| Int. to Feb. 15, 1875 | 27.197 |
| <hr/> | |
| Amount | 2380.817 |
| Second payment | 875.35 |
| <hr/> | |
| New principal | 1505.467 |
| Int. to Feb. 20, 1876 | 122.11 |
| <hr/> | |
| Amount | 1627.577 |
| Third payment | 1025.000 |
| <hr/> | |
| New principal | 602.577 |
| Int. to July 8, 1876 | 18.479 |
| <hr/> | |
| Amount due July 8, 1876 . . . | <u><u>\$621.056, Ans.</u></u> |

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|---|------------------------|
| 10. Principal | \$1885.75 |
| Int. to June 30, 1874 | 51.336 |
| First pay't (less than int. due) . | \$50 |
| Int. on same prin. from June 30, 1874, to Nov. 8, 1874 . . . | 46.935 |
| Amount | 1984.021 |
| Sum of first and second payments . | 150.000 |
| New principal | 1834.021 |
| Int. to Feb. 5, 1875 | 31.027 |
| Amount | 1865.048 |
| Third payment | 125.000 |
| New principal | 1740.048 |
| Int. to April 17, 1875 | 24.36 |
| Amount | 1764.408 |
| Fourth payment | 500.000 |
| New principal | 1264.408 |
| Int. to Dec. 1, 1875 | 55.07 |
| Amount | 1319.478 |
| Fifth payment | 500. |
| New principal | 819.478 |
| Int. to March 1, 1876 | 14.34 |
| Amount due March 1, 1876 . . . | \$833.818, <i>Ans.</i> |

PROBLEMS IN INTEREST.**Page 233.**

4. Since \$250 loaned at 6% produces \$15 annually, it will require as many years to produce \$30 as \$15 are contained times in \$30, which is 2 yr., *Ans.*
5. \$600 at 8% will produce \$48 annually; $\$24 \div \$48 = \frac{1}{2}$. Therefore it will require $\frac{1}{2}$ yr., or 6 mo., *Ans.*
6. \$115 at 6% will produce \$6.90 annually; $\$13.80 \div \$6.90 = 2$. Therefore it will require 2 yr., *Ans.*
7. \$12.60 at 7% will produce \$.882 annually; $\$4.15 \div \$.882 = 4.705$. Therefore it will require 4.705 yr., or 4 yr. 8 mo. 14 da., *Ans.*
8. \$35.25 at 7% will produce \$2.4675 annually; $\$13.25 \div \$2.4675 = 5.369$. Therefore it will require 5.369 yr., or 5 yr. 4 mo. 13 da., *Ans.*
9. Since the annual interest is 6%, or $\frac{6}{100}$, of the principal, it will require as many years to produce an amount of interest equal to the principal as $\frac{6}{100}$ is contained times in $\frac{100}{6}$, or 6% in 100%, which is $16\frac{2}{3}$ times. Therefore it will require $16\frac{2}{3}$ yr., *Ans.* Or, Since the annual interest on \$100 at 6% is \$6, it will require as many years to produce \$100 interest as \$6 is contained times in \$100, which is $16\frac{2}{3}$ times. Therefore it will require $16\frac{2}{3}$ yr.
10. Since 8% of the principal is added annually, to double itself or add 100% of the principal would require as many years as 8% is contained times in 100%, which is $12\frac{1}{2}$ times. Therefore it will require $12\frac{1}{2}$ yr., *Ans.*

11. For any sum to double itself by adding 5% annually, will require as many years as 5% is contained times in 100%, which is 20 times. Therefore it will require 20 yr., *Ans.*
12. Since 5%, or $\frac{5}{100}$, of the sum is added annually, to add a sum equal to twice the original sum will require as many years as $\frac{5}{100}$ is contained times in $\frac{100}{5}$, or 5% in 200%, which is 40 times. Therefore it will require 40 years, *Ans.*

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5. Since the interest of \$125 for 2 yr. at 1% is \$2.50, to produce \$15 in the same time it will have to be loaned at as many times 1% as \$2.50 is contained times in \$15, which is 6 times. Therefore the rate is 6%, *Ans.*
6. The interest of \$250 for 6 mo. at 1% is \$1.25; $\$8.75 \div \$1.25 = 7$. Therefore the rate is 7%, *Ans.*
7. The interest of \$415 for 2 yr. 6 mo. at 1% is \$10.375; $\$56.025 \div \$10.375 = 5\frac{2}{3}$. Therefore the rate is $5\frac{2}{3}\%$.
8. The interest of \$317 for 1 yr. 5 mo. at 1% is $\$4.48\frac{1}{2}$; $\$31.44 \div \$4.48\frac{1}{2} = 7$. Therefore the rate is 7%.
9. The interest of \$215 for 2 yr. 7 mo. 10 da. at 1% is \$5.61; $\$39.30 \div \$5.61 = 7$. Therefore the rate is 7%.
10. The interest of \$325.18 for 5 mo. 26 da. at 1% is \$1.589; $\$11.13 \div \$1.589 = 7$ nearly. Therefore the rate is 7% nearly, *Ans.*
11. The interest of \$30.18 for 63 da. at 1% is \$.0528; $\$.32 \div \$.0528 = 6$ nearly. Therefore the rate is 6% nearly, *Ans.*

12. The interest of \$24.36 for 93 da. at 1% is \$.063; \$.44 \div \$.063 = 7 nearly. Therefore the rate is 7% nearly.
13. The interest of \$25.40 for 45 da. at 1% is \$.03175; \$.397 \div \$.03175 = 12½. Therefore the rate is 12½%.
-
3. The interest of \$1 for 2 yr. at 6% is \$.12; \$36.60 \div \$.12 = 305. Therefore the sum is \$305, *Ans.*
4. The interest of \$1 for 2 yr. 6 mo. at 8% is \$.20; \$35.70 \div \$.20 = 178.50. Therefore the sum is \$178.50.
5. The interest of \$1 for 5 yr. 6 mo. at 5% is \$.275; \$51.20 \div \$.275 = 186.18. Therefore the sum is \$186.18.
6. The interest of \$1 for 6 mo. 27 da. at 6% is \$.0345; \$50.84 \div \$.0345 = 1473.62. Therefore the sum is \$1473.62, *Ans.*
7. The interest of \$1 for 5 mo. 18 da. at 6% is \$.028; \$39.18 \div \$.028 = 1399.28. Therefore the sum is \$1399.28, *Ans.*
8. The interest of \$1 for 3 mo. 15 da. at 9% is \$.02625; \$41.25 \div \$.02625 = 1571.43. Therefore the sum is \$1571.43, *Ans.*
9. The interest of \$1 for 1 mo. 12 da. at 7% is \$.008½; \$87.50 \div \$.008½ = 10714.28. Therefore the sum is \$10714.28, *Ans.*
10. The interest of \$1 for 3 mo. 10 da. at 6% is \$.01½; \$68.75 \div \$.01½ = 4125. Therefore the sum is \$4125.
11. The interest of \$1 for 2 yr. 3 mo. at 6% is \$.135; \$50.83 \div \$.135 = 376.518. Therefore the sum is \$376.518, *Ans.*

12. The interest of \$1 for 3 yr. 5 mo. at 8% is \$.27 $\frac{1}{4}$; $\$81.25 \div \$.27\frac{1}{4} = 297.26$. Therefore the sum is \$297.26, *Ans.*
-

COMMERCIAL DISCOUNT.

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3. 5% discount = 5% of \$845 = 42.25; $\$845 - \$42.25 = \$802.75$. The cash value is, therefore, \$802.74, *Ans.*
4. 2% discount = 2 $\frac{1}{2}$ % of \$680 = \$17; $\$680 - \$17 = \$663$. The cash value is, therefore, \$663, *Ans.*
5. 20% of \$3215.45 = \$643.09; $\$3215.45 - \$643.09 = \$2572.36$; 5% of \$2572.36 = \$128.618; $\$2572.36 - \$128.618 = \$2443.742$, *Ans.*
6. 10% of \$3750 = \$375; $\$3750 - \$375 = \$3375$; 2 $\frac{1}{2}$ % of \$3375 = \$84.375; $\$3375 - \$84.375 = \$3290.625$, *Ans.*
7. 15% of \$2157.25 = \$323.59; $\$2157.25 - \$323.59 = \$1833.66$; 3% of \$1833.66 = \$55.01; $\$1833.66 - \$55.01 = \$1778.65$, *Ans.*
-

TRUE DISCOUNT.

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2. The amount of \$1 for 1 $\frac{1}{2}$ yr. at 6% is \$1.09; $\$975.50 \div \$1.09 = 894.954$. Therefore the present worth is \$894.954. $\$975.50 - \$894.954 = \$80.54$, the discount.

3. The amount of \$1 for $1\frac{1}{4}$ yr. at 7% is \$1.0875; \$845.20 \div \$1.0875 = 777.195. Therefore the present worth is \$777.195. Discount = \$845.20 - \$777.195 = \$68.005.
4. The amount of \$1 for 3 yr. at 7% is \$1.21; \$958.75 \div \$1.21 = 792.355. Therefore the present worth is \$792.355. Discount = \$958.75 - \$792.355 = \$166.395.
5. The amount of \$1 for 3 yr. at 8% is \$1.24; \$576.25 \div \$1.24 = 464.717. Therefore the present worth is \$464.717. Discount = \$576.25 - \$464.717 = \$111.533.
6. The amount of \$1 for 2 yr. 3 mo. 10 da. at 5% is $\$1.11\frac{7}{8}$; $\$8575 \div \$1.11\frac{7}{8} = 7698.254$. Therefore the present worth is \$7698.254. Discount = \$8575 - \$7698.254 = \$876.746, *Ans.*
7. The amount of \$1 for 1 yr. 4 mo. 15 da. at 6% is \$1.0825; $\$4274 \div \$1.0825 = 3948.267$. Therefore the present worth is \$3948.267. Discount = \$4274 - \$3948.267 = \$325.733, *Ans.*
8. The amount of \$1 for 3 yr. 6 mo. 15 da. at 7% is \$1.247916; $\$2845 \div \$1.247916 = 2279.799$. Therefore the present worth is \$2279.799. Discount = \$2845 - \$2279.799 = \$565.201, *Ans.*
9. The amount of \$1 for 1 yr. 3 mo. 20 da. at 8% is $\$1.10\frac{1}{4}$; $\$1752.75 \div \$1.10\frac{1}{4} = 1586.996$. Therefore the present worth is \$1586.996. Discount = \$1752.75 - \$1586.996 = \$165.75, *Ans.*
10. The amount of \$1 for 2 yr. 5 mo. 25 da. at 9% is \$1.22375; $\$5493.50 \div \$1.22375 = 4489.07$. Therefore the present worth is \$4489.07. Discount = \$5493.50 - \$4489.07 = \$1004.43, *Ans.*

11. The amount of \$1 for 7 mo. 10 da. at $7\frac{1}{2}\%$ is $\$1.0458\frac{1}{8}$;
 $\$3457.84 \div \$1.0458\frac{1}{8} = 3306.30$. Therefore the present
 worth is $\$3306.30$. Discount = $\$3457.84 - \3306.30
 = $\$151.54$, *Ans.*
12. $\$16000 \div 2 = \8000 , the amount to be paid in 1 yr.;
 The amount of \$1 for 1 yr. at 6% is $\$1.06$;
 $\$8000 \div 1.06 = \7547.169 , the present worth of $\$8000$;
 $\$8000 + \$7547.169 = \$15547.169$, cash value of sale.
13. The amount of \$1 for 3 mo. at 8% is $\$1.02$;
 $\$5275 \div 1.02 = \5171.568 , the present worth;
 $\$5275 - \$5171.568 = \$103.432$, the discount;
 $2\frac{1}{2}\%$ of $\$5275 = \131.875 , commercial discount;
 $\$131.815 - \$103.432 = \$28.44$, the gain, *Ans.*
14. From Jan. 1 to Feb. 15 is 1 mo. 14 da.; $\$187.25 \div$
 $1.009\frac{7}{8} = \$185.436$, the present worth of first note
 Jan. 1, 1877.
 From Jan. 1 to April 1 is 3 mo.; $\$382.75 \div 1.02 =$
 $\$375.245$, present worth of second note Jan. 1, 1877.
 $\$185.436 + \$375.245 = \$560.68$, cash value of both
 notes Jan. 1, 1877, *Ans.*

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15. The amount of \$1 in 1 yr. 3 mo. 15 da. at 8% is $\$1.10\frac{1}{8}$;
 $\$4725 \div \$1.10\frac{1}{8} = 4282.477$. Therefore the present
 worth is $\$4282.477$. Discount = $\$4725 - \$4282.477 =$
 $\$442.523$, *Ans.*
16. $\$21.50 \times 850 = \18275 , the cost of pork. Since the gain
 was the use of the value of pork for 90 days, we find the
 simple interest of $\$18275$ for that time, which is $\$296.97$.

17. I will gain the difference between \$5400 and the present worth of \$6000 due in 1 yr. 4 mo. when money is worth 9%. $\$6000 \div 1.12 = \5357.142 , the present worth $\$5400 - \$5357.142 = \$42.858$, *Ans.*
18. There should be discounted the true discount of \$3725.87 for 8 mo. 10 da. at 10%; $\$3725.87 \div 1.06\frac{1}{8} = \3483.93 , the present worth; $\$3725.87 - \$3483.93 = \$241.94$, the discount, *Ans.*
19. $282 \text{ lb.} \times 250 = 705000 \text{ lb.}$; $\$.10\frac{1}{8} \times 705000 = \7490.625 . The present worth of this sum is obtained by dividing it by $\$1.00\frac{3}{8}$, which gives \$7441.018, *Ans.*
20. $62\frac{1}{2}\%$ of \$3725 = \$2328.125, cost of goods, $\$3725 \div 1.02\frac{3}{8} = \3628.247 , present val. of selling price; $\$3628.247 - \$2328.125 = \$1300.12$, the gain, *Ans.*

BANK DISCOUNT.

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10. Since the note bears interest we find the *amount* to the time of maturity, Feb. 23 (2 mo. 3 da.), which is \$381.562. Since the note was discounted, Jan. 23, it was discounted just 1 mo. before it became due. The bank discount of \$381.562 for 1 mo. at 10% is \$3.179, and $\$381.562 - \$3.179 = \$378.383$, *Ans.*
11. The bank discount is the simple interest upon \$890.25 for 2 mo. 3 da. at 7%, which is \$10.905. $\$890.25 - \$10.905 = \$879.34$, the proceeds, *Ans.*

12. $\$3725.85 \div 1.02 = \$3652.79 +$, true present worth;
 $\$3725.85 - \$3652.79 + = \$73.06 -$, true discount;
 Interest on $\$3725.85$ for 3 mo. 3 da. at 8% is \$77, the
 bank discount;
 $\$77 - \$73.06 - = \$3.94 +$, the difference, *Ans.*
13. The note was due July 18, 1876; and since it was discounted May 25, 1876, it was discounted 1 mo. 23 da. before maturity. Therefore, $\$15725.95 \times .008\frac{1}{2} = \$138.91 +$, the bank discount. $\$15725.95 - \$138.91 = \$15587.04$, the proceeds, *Ans.*

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14. Since he kept the note for 30 da. before discounting it, he had to pay only the discount for 63 da.; $\$3782.75 \times .014 = \52.958 , the discount; $\$3782.75 - \$52.958 = \$3729.79$, the proceeds, *Ans.*
15. $\$8.75 \times 32 = \280
 $\$2.80 \times 48 = \134.40
 $\$6.25 \times 25 = \underline{\$156.25}$
 Entire value = $\$570.65$
 $\$570.65 \times .012 = \6.847 , the discount;
 $\$570.65 - \$6.847 = \$563.803$, the proceeds, *Ans.*

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6. The proceeds of \$1 discounted for 2 mo. at 6% are \$.9895. Therefore \$989.50, are the proceeds of as many dollars as \$.9895 are contained times in \$989.50, which is \$1000, *Ans.*
7. $\$1969 \div .9845 = \2000 , *Ans.*

8. $\$975 \div .98775 = \$987.09 +$, *Ans.*
9. $\$1000 \div .9845 = \$1015.74 +$, *Ans.*
10. $\$1375.38 \div .97675 = \$1408.11 +$, *Ans.*
11. $\$1257.25 \div .996 = \$1262.29 +$, *Ans.*
12. $\$5250 \div .990\frac{2}{3} = \$5299.46 +$, *Ans.*
13. $\$1875 \div .9677\frac{1}{2} = \$1937.56 +$, *Ans.*
14. $\$500 \div .986 = \$507.09 +$, *Ans.*
15. $\$15000 \div .979\frac{1}{2} = \$15316.54 +$, *Ans.*

REVIEW EXERCISES.

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1. Since every dollar invested at 8% yields an income of \$.08, it will require as many dollars invested to yield \$1400 as \$.08 are contained times in \$1400, which is \$17500.
2. The present worth of \$7825 to be paid in 90 days is $\$7825 \div 1.02\frac{1}{4} = \7652.81 , the first offer. The commercial discount is 4% of \$7825 = \$313, and $\$7825 - \$312 = \$7512$, the second offer; $\$7652.81 - \$7512 = \$140.81$, in favor of 4% discount, *Ans.*
3. $\$62.50 \times 135\frac{25}{100} = \8447.265 , cost of farm;
 $\frac{1}{2}$ of \$8447.265 = \$2815.755, cash payment;
 $\$2815.755 \div 1.03 = \2733.744 , pres't worth 2d pay't;
 $\$2815.755 \div 1.075 = \2619.307 , pres't worth 3d pay't;
 $\$8168.806$, cash value, *Ans.*

4. The cash value of the bequest is its present worth.
 $\$4500 \div 1.0875 = \4137.93 , the present worth or cash value, *Ans.*
5. The amount of \$1 for 3 yr. at compound interest is \$1.225043, and for 2 mo. 15 da. more, it is \$1.242908;
 $\$1.242908 \times 3752 = \4663.39 , *Ans.*
6. From March 25th, 1872, to April 15, 1876, is 4 yr. 20 da. The simple interest of \$175 for that time is \$56.77;
 $\$175 + 56.77 = \231.77 , amount due, *Ans.*
7. $\$5728 \times .020\frac{1}{2} = \118.378 , the bank discount;
 $\$5728 \div 1.02 = \5615.686 , the true present worth;
 $\$5728 - \$5615.686 = \$112.314$, the true discount;
 $\$118.378 - \$112.314 = \$6.06+$, *Ans.*

| | |
|---|-----------|
| 8. Principal | \$3729.75 |
| Int. to July 15, 1872 | 90.135 |
| Amount | 3819.885 |
| First payment | 525.000 |
| New principal | 3294.885 |
| Int. to Dec. 15, 1872 | 82.372 |
| Amount | 3377.257 |
| Second payment | 478.000 |
| New principal | 2899.257 |
| Int. to Feb. 20, 1873 | 31.408 |
| Third pay't (less than int. due) . | \$25 |
| Int. on previous prin. from Feb. 20, 1873, to May 17, 1873 . . . | 42.039 |
| Amount | 2972.704 |

| | |
|--|--------------------------------|
| (<i>Brought forward</i>) | \$2972.704 |
| Sum of third and fourth payments | 100.000 |
| New principal | 2872.704 |
| Int. to Sept. 28, 1873 | 62.718 |
| Amount | 2935.422 |
| Fifth payment | 1000.000 |
| New principal | 1935.422 |
| Int. to Jan. 15, 1874 | 34.513 |
| Amount due | <u>\$1969.935, <i>Ans.</i></u> |

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9. $\$3.75 \times 8790 = \32962.50 , cost of coal; $\$32962.50 \times .03\frac{1}{2} = \1153.687 , cost of transportation; the cost of 15% of coal was 15% of $\$32962.50$, which was $\$4944.375$, and 10% of this sum, or $\$494.437$, was gained upon it. The cost of 40% of coal was 40% of $\$32962.50$, which was $\$13185$, and 5% of this sum, or $\$659.25$, was gained upon it. The cost of the rest was $\$14833.125$, and 8% of this sum, or $\$1186.65$, was the gain upon it; $\$494.437 + \$659.25 + \$1186.65 = \2340.337 , the entire gains; $\$2340.337 - \$1153.687 = \$1186.65$, net gain, *Ans.*
10. $\$.85 \times 10000 = \8500 , cost of barley;
 4% of $\$8500 = \340 , the advance received;
 $\$8500 + \$340 = \$8840$, the selling price and face of note;
 $\$8840 \times .008\frac{1}{4} = \72.93 , the bank discount;
 $\$340 - \$72.93 = \$267.07$, the entire gain, *Ans.*

11. Since he paid $62\frac{1}{2}\%$ of the cost in cash, and the rest in notes, he paid $100\% - 62\frac{1}{2}\%$, or $37\frac{1}{2}\%$, or $\frac{3}{8}$, of cost in notes. Therefore, since $\frac{3}{8}$ of cost of house is \$3300, $\frac{1}{8}$ of cost of house is \$1100; the cost of house was $\$1100 \times 8$, or \$8800, *Ans.*
12. $15\% + 10\% = 25\%$, the part of stock sold during first two months. Therefore there was 75% of stock unsold. 25% of 75% , or $18\frac{3}{4}\%$, is the part of stock sold during the third month. Therefore there was left $75\% - 18\frac{3}{4}\%$, or $56\frac{1}{4}\%$, or $\frac{9}{16}$, of the stock. Therefore, $\frac{9}{16}$ of the value of the stock was \$5300; $\frac{1}{16}$ of the value of the stock was \$588 $\frac{2}{3}$; the whole value of the stock was $\$588\frac{2}{3} \times 16$, or \$9422.22, *Ans.*
13. $\frac{3}{8}$ of 25% of $\frac{1}{3}$ of 480 = $\frac{3}{8}$ of $\frac{1}{3}$ of $\frac{1}{3}$ of 480 = 9; 25% of $\frac{3}{8}$ of 50% of 324 = $\frac{1}{4}$ of $\frac{3}{8}$ of $\frac{1}{2}$ of 324 = 36. Therefore, since a certain number + 9 = 36, the number = 36 - 9, or 27, *Ans.*
14. Since the discount of \$1 for 63 da. at 6% was \$.0105; \$31.50 is the discount of as many dollars as \$.0105 is contained times in \$31.50, which is \$3000. Therefore the note was for \$3000, which was $\frac{1}{3}$ of the value of the flour. Therefore the value of the flour was 3 times \$3000, or \$9000. $\$9000 \div 1000 = \9 , the price per bbl.
15. Since the simple interest of \$1 for 2 yr. 2 mo. 15 da. at 6% is \$.1325, the simple interest of \$4725.50 is 4725.50 times \$.1325, which is \$626.128. The compound interest of \$1 for 2 yr. at 6% is \$.1236, and the interest of this sum for 2 mo. 15 da. more is \$.137645. Therefore the compound interest of \$4725.50 is 4725.50 times \$.137645, which is \$650.441. $\$650.441 - \$626.128 = \$24.31$.

16. The simple interest of \$3240 for 5 yr. 3 mo. 10 da. at 7% is \$1197; the amount is \$4437. The annual interest is equal to \$1197, the simple interest for the entire time *plus* the interest upon each year's interest from the time it was due up to the end of the period. The annual interest is \$226.80.

The 1st year's int. was unpaid for 4 yr. 3 mo. 10 da.

The 2d " " " " " 3 yr. 3 mo. 10 da.

The 3d " " " " " 2 yr. 3 mo. 10 da.

The 4th " " " " " 1 yr. 3 mo. 10 da.

The 5th " " " " " 3 mo. 10 da.

Equivalent to annual int. for 11 yr. 4 mo. 20 da.

The interest of \$226.80 for 11 yr. 4 mo. 20 da. at 7% is \$180.81, and the amount due at annual interest is \$3240 + \$1197 + \$180.81, which is \$4617.81; \$4617.81 — \$4437 = \$180.81, *Ans.*

17. Since the income from \$1 in 6 mo. 12 da. at 6% is \$.032, \$640 is the income from as many dollars as \$.032 is contained times in \$640, which is 20000 times. Therefore the investment is \$20000. Since \$20000 is $\frac{1}{5}$ of annual income, his income must be 5 times \$20000, or \$100000, *Ans.*

PROFIT AND LOSS.

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2. $\$275 \times 1.25 = \343.75 , amount received, *Ans.*

3. $\$3584 \times .10 = \358.40 , amount gained, *Ans.*

4. $\$318.25 \times 1.25 = \397.81 , amount received, *Ans.*
5. $\$45 \times 1.15 = \51.75 , amount received, *Ans.*
6. $\$45 \times .12 = \5.40 , amount gained, *Ans.*
7. $\$84.25 \times 1.15 = \$96.88\frac{1}{4}$, amount received, *Ans.*
8. $\$6000 \times 1.08 = \6480 , amount received, *Ans.*
9. $\$3000 \times 1.15 = \3450 , amount received, *Ans.*
10. $\$1500 \times 1.07 = \1605 , amount received, *Ans.*
11. $\$250 \times 1.09 = \272.50 , amount received, *Ans.*
12. $\$2.15 \times 1.30 = \2.795 , the selling price, *Ans.*

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13. $\$65 \times 1.15 = \74.75 , the selling price, *Ans.*
14. $\$.09\frac{1}{2} \times 3950 = \375.25 , amount paid for cotton;
 $\$375.25 \times 1.12\frac{1}{2} = \$422.15\frac{5}{8}$, the selling price, *Ans.*
15. $\$3.60 \times 1.33\frac{1}{3} = \4.80 , the marked price, *Ans.*
16. 100% of cost — 35% of cost = 65%, the selling price;
 $\$.50 \times .65 = \$.325$; $\$1 \times .65 = \$.65$;
 $\$1.50 \times .65 = \$.975$; $\$1.75 \times .65 = \1.1375 , *Ans.*
18. $\$1 - \$.75 = \$.25$; $\$.25 \div \$.75 = 33\frac{1}{3}\%$, gain, *Ans.*
19. $\$1 - \$.75 = \$.25$; $\$.25 \div \$1 = 25\%$, loss, *Ans.*
20. $\$1.75 - \$1.25 = \$.50$; $\$.50 \div \$1.75 = 28\frac{4}{7}\%$, loss.
21. $\$.60 - \$.50 = \$.10$; $\$.10 \div \$.50 = 20\%$, gain, *Ans.*
22. $\$.12\frac{1}{2} - \$.10 = \$.02\frac{1}{2}$; $\$.02\frac{1}{2} \div \$.10 = 25\%$, gain.
23. $\$5000 - \$4500 = \$500$; $\$500 \div \$4500 = 11\frac{1}{9}\%$, gain.
24. $\$970 - \$850 = \$120$; $\$120 \div \$970 = 12\frac{4}{97}\%$, loss.

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25. $\$.05 - \$.04\frac{1}{2} = \$.00\frac{1}{2}$; $\$.00\frac{1}{2} \div \$.05 = 2\frac{1}{2}\%$, loss.
26. $\$1.75 \times 10 = \17.50 , cost of purchase;
 $\$17.50 \times 1.05 = \18.375 , the selling price;
 $\$18.375 \div 8 = \2.296 , price per box, *Ans.*
 $\$18.375 - \$17.50 = \$.875$, gain, *Ans.*
27. $\$1.50 \times .90 = \1.35 , the cost;
 $\$1.50 - \$1.35 = \$.15$; $\$.15 \div \$1.35 = 11\frac{1}{3}\%$, gain.
28. The agent pays only 60% of retail price, and since he sells them for the retail price, he gains 40% of the retail price on an investment of 60%; or he gains $\frac{4}{6}$, or $\frac{2}{3}$, or $66\frac{2}{3}\%$, of his investment, *Ans.*
29. $\$3.25 + \$.0975$, the interest for 6 mo. = $\$3.3475$, the cost at the end of 6 mo.;
 $\$3.75 - \$3.3475 = \$.4025$;
 $\$.4025 \div \$3.3475 = 12 + \%$, gain, *Ans.*
30. $\$1.30 \div 1.07 = 1.21\frac{53}{107}$, the present worth of 130% of cost in one year;
 $125\% - 121\frac{53}{107}\% = 3\frac{54}{107}\%$, the difference in favor of cash now, *Ans.*
31. If Mr. A. sells the goods for the retail price, his profit is 30% of the retail price on an investment of 70%; or $\frac{3}{7}$, or $\frac{3}{7} = 42\frac{6}{7}\%$, *Ans.* Since Mr. B. gets a discount of 5% more, he pays but 95% of 70% of the retail price, which is $66\frac{1}{2}\%$. Therefore Mr. B.'s gain is $100\% - 66\frac{1}{2}\%$, or $33\frac{1}{2}\%$, on an investment of $66\frac{1}{2}\%$ of the retail price; or $\frac{33\frac{1}{2}}{66\frac{1}{2}}\%$, or $\frac{67}{133}$, or $50\frac{50}{133}\%$, B.'s gain, *Ans.*

- 32.** Since he received a discount of 20% of the market value and 5% for cash, every dollar's worth of goods at market value cost him only \$.76; for he could purchase the goods at \$.80, and obtain besides an allowance of 5% of \$.80, or \$.04, for paying cash. If he sells each dollar's worth of goods at their market value, for \$1.15, his gain will be 39 cents on an investment of 76 cents, or $\frac{39}{76}$, or $51\frac{6}{13}\%$, of his investment, *Ans.*

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- 34.** \$.10 is 10%, or $\frac{1}{10}$, of \$1.00, the cost, *Ans.*
 $\$1.00 + \$.10 = \$1.10$, the selling price, *Ans.*
- 35.** \$1.50 is $16\frac{2}{3}\%$, or $\frac{1}{6}$, of \$9.00, the cost, *Ans.*
- 36.** \$.12 is 12%, or $\frac{12}{100}$, of \$1.00, the cost, *Ans.*
- 37.** \$.08 is 20%, or $\frac{1}{5}$, of \$.40, the cost, *Ans.*
- 38.** \$.22 is 40%, or $\frac{2}{5}$, of \$.55, the cost, *Ans.*
- 39.** $\$25 - \$10 = \$15$, the net cost;
 $\$15$ is 15%, or $\frac{3}{20}$, of \$100, the cost, *Ans.*
- 40.** \$75 is 25%, or $\frac{1}{4}$, of \$300, the cost, *Ans.*
- 41.** \$.25 is $12\frac{1}{2}\%$, or $\frac{1}{8}$, of \$2.00, the cost, *Ans.*
- 42.** \$.23 is 20%, or $\frac{1}{5}$, of \$1.15, the cost, *Ans.*
- 43.** $100\% + 25\%$ of cost = 125% , asking price;
 90% of 125% or $112\frac{1}{2}\%$ of cost = selling price;
 $125\% - 112\frac{1}{2}\% = 12\frac{1}{2}\%$ of cost, the per cent. gained;
 \$4684 is $12\frac{1}{2}\%$, or $\frac{1}{8}$, of \$37472, the cost, *Ans.*

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46. $\$.50 \div 1.25 = \$.40$, the cost, *Ans.*
 47. $\$38000 \div .95 = \40000 , the cost, *Ans.*
 48. $\$185000 \div 1.15 = \160869.56 , the cost, *Ans.*
 49. $\$.09\frac{1}{2} \div .95 = \$.10$, the cost, *Ans.*
 50. $\$3582 \div .66\frac{1}{2} = \5373 , the cost, *Ans.*
 51. $\$.65 \div 1.30 = \$.50$, the cost, *Ans.*
 52. $\$1250 \div .62\frac{1}{2} = \2000 , the cost, *Ans.*
 53. $\$3.75 \div .91 = \$4.12\frac{2}{11}$, the cost, *Ans.*
 54. $\$2.22 \div .74 = \3.00 , the cost, *Ans.*
 55. $\$3.50 \div 2.25 = \$1.55\frac{5}{9}$, the cost, *Ans.*
 56. $\$4.56\frac{1}{2} \div .83 = \5.50 , the cost, *Ans.*
 57. $\$4.50 \div .90 = \5.00 , the cost; $\$6.00 - \$5.00 = \$1.00$,
 or the gain. Therefore the gain is $\frac{1}{5}$, or 20%, of the
 cost, *Ans.*
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COMMISSION.

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5. Since the agent gets a commission of 3%, it requires \$1.03 to purchase \$1.00 worth of goods for me. He can therefore purchase as many dollars' worth of goods as \$1.03 is contained times in \$4050; $\$4050 \div 1.03 = \3932.03

6. $\$875 \div 1.02 = \857.843 , amount invested;
 $\$857.84 \div \$.06 = 14297.3 + \text{yd.}$, *Ans.*

7. $\$6.50 \times 385 = \2502.50 , selling price;
 $\$2502.50 \times .02 = \50.05 , commission, *Ans.*

8. $\$784.25 \times .05 = \$39.21\frac{1}{4}$, commission, *Ans.*

9. $\$12.75 \times 25 = \318.75 , selling price;
 $\$318.75 \times .06 = \19.125 , commission, *Ans.*

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10. $\$2.37\frac{1}{2} \times 125 = \296.875 , selling price;
 $\$296.875 \times .03 = \8.91 , commission, *Ans.*

11. $\$.28 \times 56 \times 20 = \313.60 , selling price;
 $\$313.60 \times .08 = \25.088 , commission, *Ans.*

12. $\$.23 \times 22 \times 20 = \101.20 , selling price;
 $\$101.20 \times .07 = \7.084 , commission, *Ans.*

13. $\$928.75 \times .03\frac{3}{4} = \34.828 , commission, *Ans.*

14. $\$1525 \div 1.02 = \1495.09 , amount invested, *Ans.*

15. $\$375.50 \div 1.03 = \364.563 , amount invested;
 $\$364.563 \div \$.08 = 4557.03 + \text{yd.}$, *Ans.*

16. $\$3320.10 \div 1.02 = \3255 , amount invested, *Ans.*

17. $\$3725.05 \div 1.01\frac{1}{2} = \3670 , amount invested, *Ans.*

18. $\$8966.75 \div 1.00\frac{3}{4} = \8900 , amount invested;
 $\$8900 \div \$1.11\frac{1}{4} = 8000 \text{ bu.}$, *Ans.*
 $\$8966.75 - \$8900 = \$66.75$, commission, *Ans.*

19. Since his commission was computed upon the selling price of the goods, 2% of selling price was \$24.52; 1% of the selling price was \$12.26; entire selling price was \$1226, *Ans.*
20. $\$8.25 \times 150 = \1237.50 , the price of flour;
 $\$1237.50 \times .03 = \underline{37.125}$, commission;
 $\$1274.625$, amount remitted, *Ans.*
21. Since \$318.25 was received for selling \$12730 worth of goods, $\$318.25 \div \$12730 = .02\frac{1}{2}$, or $2\frac{1}{2}\%$, *Ans.*
22. $\$2396.49 + \$324.18 = \$2720.67$, the proceeds after the commission only was taken out. Since 2 per cent. of the sales was paid for commission, \$2720.67 is but 98 per cent. of the sales. Therefore, $\$2720.67 \div .98 = \2776.19 , the selling price, *Ans.*

REVIEW EXERCISES.

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1. $33\frac{1}{3}\%$ or $\frac{1}{3}$ of \$27 = \$9, reduction, *Ans.*
2. $\$375 - \$300 = \$75$, the gain. Therefore the gain is $\frac{75}{300}$, or $\frac{1}{4}$, or 25% of the cost, *Ans.*
3. $\$.11 - \$.10 = \$.01$, the gain. Therefore the gain is $\frac{1}{10}$ or 10% of the cost, *Ans.*

4. The gain is $\frac{40}{12}\%$, or $\frac{1}{3}$, or $33\frac{1}{3}\%$ of the cost, *Ans.*
5. Since he bought them at $\frac{2}{3}$ of a cent each and sold them at $1\frac{1}{2}$ cents each, his gain was $1\frac{1}{2} - \frac{2}{3} = \frac{5}{6}$ of a cent on each. Therefore he gained 5 cents on every 6 apples, which cost him 4 cents. Hence his gain was $\frac{5}{4}$ or 125% of the cost, *Ans.*
6. $\$31 \times .10 = \3.10 , the commission, *Ans.*
7. Since \$80 was 20% , or $\frac{1}{5}$ of his money, his money was 5 times \$80, which was \$400, *Ans.*
8. The price realized was 98% of selling price; therefore, $\$1.47 \div .98 = \1.50 , the selling price, *Ans.*
9. Interest on \$240 for 2 yr. at 1% is \$4.80; $\$28.80 \div \$4.80 = 6$, the rate per cent., *Ans.*
10. Interest on \$1000 for 1 yr. at 6% is \$60; $\$75 \div \$60 = 1\frac{1}{4}$, the number of years, *Ans.*
11. He gains $\frac{1}{3}$ of their value on an investment equal to $\frac{2}{3}$ of their value; or his gain is equal to $\frac{1}{2}$ or 50% of his investment, *Ans.*
12. Since the goods that he sells for \$1.00 cost but \$.70, his gain is \$.30 on every \$.70, or $\frac{3}{7}$, or $42\frac{4}{7}\%$ of the investment, *Ans.*
13. At 3% off for cash, the cost = 97% of price asked; if paid in 90 days, when money is worth 8% , the cost now = $100\% \div 1.02$, or $98\frac{2}{51}\%$ of price asked; $98\frac{2}{51}\% - 97\% = 1\frac{2}{51}\%$, gained by paying cash, *Ans.*
14. I lose \$50 on the cost, which was \$175, or $\frac{50}{175}$, or $\frac{2}{7}$, or $28\frac{4}{7}\%$ of the cost, *Ans.*

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15. Since \$10 was 25%, or $\frac{1}{4}$ of the cost of the cow, the entire cost was 4 times \$10, which was \$40, *Ans.*
16. The boy can pick $33\frac{1}{3}$ per cent., or $\frac{1}{3}$ of 18 barrels, or 6 barrels, *Ans.*
17. Goods of which the regular price is \$1.00 he buys for \$.80 and sells for \$1.20; therefore he gains \$.40 on an investment of \$.80; or $\frac{40}{80}$, or $\frac{1}{2}$, or 50% of the investment, *Ans.*
18. The gain per yard will be the difference between \$.20 and the present worth of \$.21. $$.21 \div 1.06 = $.198113+$, the present worth of \$.21, to be realized in 1 yr.; $$.20 - $.198113+ = $.001887$, the gain per yard in favor of selling for \$.20 now; $\$1000 \div $.18 = 5555\frac{5}{9}$, the number of yards; $$.001887 \times 5555\frac{5}{9} = \$10.48+$, in favor of selling now for \$.20, *Ans.*
19. Since he sold the carriage at a loss of 20%, he received for it but 80% of its cost; since he sold the horse at a gain of 25%, he received for it 125% of its cost; or since the horse was worth twice as much as the carriage, he received a sum equal to 250% of the cost of the carriage. The sum received for both would therefore be equal to $80\% + 250\% = 330\%$ of cost of carriage; 330% of cost of carriage = \$577.50; 1% of cost of carriage = \$1.75; the entire cost of carriage = 100 times \$1.75, which is \$175, *Ans.* The cost of the horse was 2 times \$175 = \$350, *Ans.*

20. The discount of \$1.00 for the given time at the given rate was $$.018\frac{1}{2}$, and the proceeds $\$1.00 - $.018\frac{1}{2}$, or $$.981\frac{1}{2}$. Therefore, \$468.39 is the proceeds of as many dollars as $$.981\frac{1}{2}$ is contained times in that sum; $\$468.39 \div .981\frac{1}{2} = \$477.01 +$, *Ans.*

21. Invoice of goods. \$1500
 2% discount 30

 Cash value of goods \$1470
 Interest on that sum for 60 da. at 6% . . . 14.70

 Cost of goods in 60 da. by borrowing money. \$1484.70
 $\$1500 - \$1484.70 = \$15.30$, difference in favor of borrowing money and paying cash, *Ans.*

22. The bank discount of \$1.00 for the given time at the given rate is $$.018\frac{1}{2}$; the proceeds are $\$1.00 - .018\frac{1}{2} = $.981\frac{1}{2}$; $$.981\frac{1}{2} \times 1000 = \981.916666 , the proceeds of \$1000; $\$981.916666 \div \$1.65 = 595.1 +$ bu.

23. Since he received 10% less than he asked, 90% of asking price = \$198; 1% of asking price = \$2.20; asking price = \$220. Since he asked 10% more than the cost, 110% of the cost = \$220; 1% of the cost = \$2.00; the cost = \$200, *Ans.*

24. Since gain is computed upon the cost, 25% of cost to me = \$25; 1% of the cost to me = \$1; entire cost to me = \$100, *Ans.* Since Mr. A. sold him to me for 20% less than he paid for him, he received but 80% of the cost. Therefore, 80% or $\frac{4}{5}$ of cost to A. = \$100; $\frac{1}{5}$ of cost to A. = \$25; Entire cost to A. = \$125, *Ans.*

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25. $\$650 \times 30 = \19500 , amount paid for lots;
 $\$4.25 \times 30 = 127.50$, paid for examining titles;
 $\$19500 \times .04 = 780.00$, commission;

$\$20407.50$, entire cost, *Ans.*

26. $\$20407.50 \times .20 = \4081.50 , amount to be gained;
 $\$20407.50 + \$4081.50 = \$24489$, proceeds after commission is paid. Since the agent received 5% on all sums collected, this sum is but 95% of the amount to be collected. Therefore, $\$24489 \div .95 = \25777.89 +, selling price, *Ans.*

27. Therefore, $\$3896.74$ was $118\frac{1}{2}\%$ of the original sum. Therefore, $\$3896.74 \div 1.18\frac{1}{2} = \3288.38 , sum at interest, *Ans.*

28. Since gain or loss is reckoned upon the cost, 120% or $\frac{6}{5}$ cost of one suit = \$72; $\frac{1}{5}$ of cost of one suit = \$12; of cost of one suit = \$60; and 80% or $\frac{4}{5}$ of cost of other suit = \$72; $\frac{1}{5}$ of cost of other suit = \$18; cost of other suit = \$90; $\$72 \div \frac{4}{5} = \144 , the selling price; $\$90 + \$60 = \$150$, the cost; $\$150 - \$144 = \$6$, the loss, *Ans.* The loss was \$6 on an investment of \$150, or $\frac{6}{150}$, or $\frac{1}{25}$, or 4%, of the investment, *Ans.*

29. Goods that cost \$1 were marked to sell at \$1.25; 20% of \$1.25 = \$.25, abatement from marked price; $\$1.25 - \$.25 = \$1.00$, selling price. Since cost and selling price were equal, he neither gained nor lost, *Ans.*

30. $\frac{2}{3}$ of \$10000 = \$4000; $\$4000 \times .33\frac{1}{3}$ or $\frac{1}{3}$ = \$1333.33 $\frac{1}{3}$, gain;
 $\$4000 + 1333.33\frac{1}{3} = \$5333.33\frac{1}{3}$, amount received for $\frac{2}{3}$ of property;
 $\frac{2}{3}$ of \$10000 = \$6666.66 $\frac{2}{3}$, face of note received for rest;
 $\$6666.66\frac{2}{3} \times .0155 = \$103.33\frac{1}{3}$, bank discount;
 $\$6666.66\frac{2}{3} - \$103.33\frac{1}{3} = \$6563.33\frac{1}{3}$, cash val. last sale;
 $\$5333.33\frac{1}{3} + \$6563.33\frac{1}{3} = \$11896.66\frac{2}{3}$, entire receipts;
 $\$11896.66\frac{2}{3} - \$10000 = \$1896.66\frac{2}{3}$, entire gain;
 $\$1896.66\frac{2}{3} \div \$10000 = 18.96 + \%$, *Ans.*
31. $\$7000 \div 1.03 = \$6796.11 +$, am't invested in wheat;
 $\$6796.11 \div \$1.15 = 5909.66$, No. of bu. purchased;
 $\$.06 \times 5909.66 = \$354.579 +$, storage;
 $\$7000 \times .03 = \210 , interest;
 $\$7000 + \$354.579 + \$210 = \$7564.579 +$, entire cost;
 $\$1.33 \times 5909.66 = \$7859.847 +$, face of note;
 $\$7859.847 \times .02 = \$157.196 +$, commission;
 $\$7859.847 \times .008\frac{1}{4} = \$64.843 +$, bank discount;
 $\$7859.847 - (\$157.196 + \$64.843) = \$7637.808 +$,
 net cash value of sales;
 $\$7637.808 - \$7564.579 = \$73.229$, gain, *Ans.*
32. He sold the cow for 90% of asking price, and the horse for 80% of what he asked for him, or 240% of what he asked for the cow. For both, therefore, he received a sum equal to 90% + 240% or 330% of the sum asked for the cow. 330% of sum asked for cow = \$165; 1% of sum asked for cow = \$.50; entire sum asked for cow = \$50; sum asked for horse was three times \$.50 = \$150. Price received for cow was 90% of \$50 = \$45, *Ans.* Price received for horse was 80% of \$150 = \$120, *Ans.*

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33. I owe A a certain sum; I owe B $66\frac{2}{3}\%$, or $\frac{2}{3}$ of sum due A; I owe C 40% , or $\frac{2}{5}$ of $\frac{2}{3}$ of the sum due A, or $\frac{4}{15}$ of the sum due A; $\frac{2}{3}$ of sum due A — $\frac{4}{15}$ of sum due A = $\frac{6}{15}$ of sum due A. Therefore, $\frac{6}{15}$ of sum due A = \$80; $\frac{1}{15}$ of sum due A = \$13 $\frac{1}{3}$. The sum due A = 15 times \$13 $\frac{1}{3}$, or \$200, *Ans.* The sum due B = $\frac{2}{3}$ of \$200 = \$133 $\frac{1}{3}$, *Ans.* The sum due C = $\frac{2}{5}$ of \$133 $\frac{1}{3}$ = \$53 $\frac{1}{3}$, *Ans.*
34. In order to gain 20% , coffee must be sold for \$.28 $\frac{1}{2}$ \times 1.20, which is \$.342. Since 5% of the quantity is lost, \$.342 is 95% of the amount to be received to balance the loss; \$.342 \div .95 = \$.36. Since 10% of sales is lost by bad debts, \$.36 is but 90% of the amount to be received so as to balance all losses. \$.36 \div .90 = \$.40, *Ans.*
35. Since 3% of purchase price of cambrics = \$126.30, 1% of purchase price of cambrics = \$42.10; purchase price of cambrics = \$4210; \$4210 + \$126.30 = \$4336.30, cost of cambrics. Since 2% of the sale of prints was received for commission, \$4336.30 was 98% of selling price of prints. \$4336.30 \div .98 = \$4424.79 +, *Ans.*
36. \$46 \div 1.15 = \$40, cost of first suit; \$46 — \$40 = \$6, gain on first suit, and loss on second; \$60 + \$6 = \$66, the cost of second suit. Therefore the loss was $\frac{6}{66}$, or $\frac{1}{11}$, or $9\frac{1}{11}\%$, of second suit, *Ans.*
37. If he sold it at $12\frac{1}{2}\%$ less than his asking price, he received but $87\frac{1}{2}\%$, or $\frac{7}{8}$ of his asking price. Therefore, $\frac{7}{8}$ of his asking price = \$7; $\frac{1}{8}$ of his asking price =

- \$1; asking price = \$8. Since his asking price was $33\frac{1}{3}\%$, or $\frac{1}{3}$ more than the cost, therefore $\frac{1}{3}$ of the cost = \$8; $\frac{1}{3}$ of the cost = \$2; cost = \$6, *Ans.*
38. In order to gain 20%, the apples must be sold for 120% of \$3, which is \$3.60. If I wish to ask such a price that I may reduce it 20% and still get \$3.60, then \$3.60 is 80% of the asking price. Therefore, $\$3.60 \div .80 = \4.50 , the asking price, *Ans.*
39. Since commission is reckoned upon purchase price, $\frac{1}{4}\%$ of price of wool = \$45; $\frac{1}{4}\%$ of price of wool = \$15; 1% of price of wool = \$60; entire price of wool = \$6000; $\$6000 + \45 (the commission) = \$6045, the amount of the note lacking bank discount and commission. The commission was 3% of the sales of blankets, or the face of the note, and the bank discount was .0055 of the face of the note. Therefore, \$6045 lacked $.03 + .0055$, or .0355, of the face of the note of being equal to the face of the note, or \$6045 was .9645 of the face of the note. Therefore, $\$6045 \div .9645 = \6267.49 , the face of the note and value of sale of blankets, *Ans.* $\$6000 \div \$.30 = 20000$, the pounds of wool, *Ans.*
40. If he had purchased the goods for \$60 less than he did, they would have cost 100% of cost — \$60. Since, by buying at this price, he would have gained 25% by the sale, the selling price was 125% of what they would have cost, or 125% of (100% of cost — \$60), which was 125% of cost — \$75. From the conditions first given, the selling price was equal to 120% of the cost. Therefore, $125\% \text{ of cost} - \$75 = 120\% \text{ of cost}$; 5% of cost = \$75; 1% of cost = \$15; cost = \$1500, *Ans.*

TAXES.

3. $$.75 \times 425 = \318.75 , amount of poll tax;
 $\$5008.125 - \$318.75 = \$4689.375$, property tax;
 The rate is equal to $\$4689.375 \div \1250500 , or .00375.

| | | |
|------------------|---------------------------|--------------|
| A's property tax | $= \$18500 \times .00375$ | $= \$69.375$ |
| A's poll tax | $= $.75 \times 5$ | $= 3.75$ |
| A's entire tax | | $= \$73.125$ |
| B's property tax | $= \$22180 \times .00375$ | $= \$83.175$ |
| B's poll tax | $= $.75 \times 8$ | $= 6.000$ |
| B's entire tax | | $= \$89.175$ |
| C's property tax | $= \$15200 \times .00375$ | $= \$57.00$ |
| C's poll tax | $= $.75 \times 9$ | $= 6.75$ |
| C's entire tax | | $= \$63.75$ |

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4. 300 polls @ \$1.50 = \$450; $\$2587 - \$450 = \$2137$, the amount to be raised by tax upon property. The rate of taxation is equal to $\$2137 \div \950000 , which is .003591 + *Ans.* $\$3400 \times .003591 = \12.211 +, *Ans.*
5. 275 polls @ \$1 = \$275; $\$2310.90 - \$275 = \$2035.90$, the amount to be raised by tax on the property. $\$2035.90 \div \$895970 = .002272$ +, rate, *Ans.*
6. 650 polls @ \$1.25 = \$812.50; $\$35000 - \$812.50 = \$34187.50$, the amount to be raised by tax on the property; $\$34187.50 \div \$4506000 = .007587$ +, the rate. $\$11000 \times .007587 = \83.457 , *Ans.*

7. Since the collector receives 2% of all money collected, \$3750 is 98% of the sum to be raised; $\$3750 \div .98 = \3826.53 , the sum to be raised, *Ans.* $\$3826.53 \div .003275 = \$1168406.+$, *Ans.*

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2. $3750 \text{ lb.} \times .05 = 187.5 \text{ lb.}$, the tare;
 $3750 \text{ lb.} - 187.5 = 3562.5 \text{ lb.}$, the net weight;
 $\$.05 \times 3562.5 = \178.125 , the duty, *Ans.*
3. $500 \text{ lb.} \times .15 = 75 \text{ lb.}$, the tare;
 $500 \text{ lb.} - 75 \text{ lb.} = 425 \text{ lb.}$, net weight;
 $\$.10 \times 425 = \42.50 , value of raisins;
 $\$42.50 \times .06 = \2.55 , the duty, *Ans.*
4. $\$3000 \times .15 = \450 , the duty, *Ans.*
5. $\$.17 \times 2240 \times 7 = \2665.60 , invoiced price;
 $\$2665.60 \times .20 = \533.12 , the duty, *Ans.*
6. $63 \text{ gal.} \times 75 = 4725 \text{ gal.}$, the quantity of molasses;
 $4725 \times .07 = \underline{330.75} \text{ gal.}$, the leakage of molasses;
 4394.25 gal. , net quantity of molasses;
 $\$.35 \times 4394.25 = \1537.9875 , the value of molasses;
 $\$1537.9875 \times .25 = \$384.496 +$, the duty on molasses;
 $500 \text{ lb.} - 45 \text{ lb.} = 455 \text{ lb.}$, net weight of hhd. sugar;
 $445 \text{ lb.} \times 125 = 56875 \text{ lb.}$, the net weight of sugar;
 $\$.06 \times 56875 = \3412.50 , the value of sugar;
 $\$3412.50 \times .30 = \1023.75 , the duty on sugar;
 $\$8 \times 800 = \6400 , the value of cigars;
 $\$6400 \times .60 = \3840 , the duty on cigars;
 $\$384.496 + \$1023.75 + \$3840 = \$5248.246 +$, the entire duty, *Ans.*

7. $\$65 \times 45 = \2925 , invoice price of sherry;
 $\$60 \times 56 = \3360 , invoice price of Madeira;
 $\$37 \times 38 = \1406 , invoice price of German;
 $\$7691$, invoice price of all the wine.

Since 4% leakage was allowed, it will be the same as if 4% of the invoice price was allowed. $\$7691 \times .04 = \307.64 , allowed for leakage; $\$7691 - \$307.64 = \$7383.36$, the dutiable value of the goods; $\$7383.36 \times .45 = \3322.512 , the duty, *Ans.*

STOCKS.

Since the brokerage is reckoned upon the par value of stocks (Art. 427), the rate of cost to a purchaser will be equal to the sum of the brokerage and quoted rate; the rate of sales to a seller will be equal to the quoted rate less the brokerage.

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2. $68\frac{1}{2}\% + \frac{1}{4}\% = 68\frac{3}{4}\%$; $\$12500 \times .68\frac{3}{4} = \8593.75 .
 3. $108\frac{1}{4}\% + \frac{1}{8}\% = 108\frac{3}{8}\%$; $\$8000 \times 1.08\frac{3}{8} = \8670 .
 4. $28\frac{1}{4}\% + \frac{1}{4}\% = 29\%$; $\$5500 \times .29 = \1595 , *Ans.*
 5. $108\frac{1}{4}\% + \frac{1}{8}\% = 108\frac{3}{8}\%$; $\$5000 \times 1.08\frac{3}{8} = \5418.75 .
 6. $\$3500 \times .08\frac{1}{4} = \288.75 , *Ans.*
 7. $100\% - 15\frac{1}{2}\% = 84\frac{1}{2}\%$; $\$13500 \times .84\frac{1}{2} = \11407.50 .

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9. $102\frac{1}{8}\% + \frac{1}{8}\% = 103\%$; $\$2575 \div 1.03 = \$2500 = 25$ shares, *Ans.*
10. $98\frac{1}{4}\% + \frac{1}{4}\% = 99\%$; $\$28710 \div .99 = \$29000 = 290$ shares, *Ans.*
11. $109\frac{1}{8}\% + \frac{1}{8}\% = 110\frac{1}{8}\%$; $\$66075 \div 1.10\frac{1}{8} = \$60000 = 600$ shares, *Ans.*
12. $100\% - 4\% + \frac{1}{4}\% = 96\frac{1}{4}\%$; $\$3330.25 \div .96\frac{1}{4} = \$3460 = 34.6$ shares, *Ans.*
13. $100\% - 3\% + \frac{1}{4}\% = 97\frac{1}{4}\%$; $\$2150.50 \div .97\frac{1}{4} = \$2211 + = 22.11 +$, shares, *Ans.*
15. $37\% + \frac{1}{4}\% = 37\frac{1}{4}\%$;
 $\$1299 \div .37\frac{1}{4} = \3487.24 , par value of stock;
 $\$3487.24 \times .06 = \$209.234 +$, income.
16. $45\% + \frac{1}{4}\% = 45\frac{1}{4}\%$;
 $\$4696.25 \div .45\frac{1}{4} = \10378.45 , par value of stock;
 $\$10378.45 \times .06 = \$622.707 +$, income, *Ans.*
17. $\$5000 \div .75 = \$6666.66\frac{2}{3}$, par value of 6% stock;
 $\$6666.66\frac{2}{3} \times .06 = \400 , income from 6% stock;
 $\$5000 \div .60 = \$8333.33\frac{1}{3}$, par value of 5% stock;
 $\$8333.33\frac{1}{3} \times .05 = \$416.666 +$, income from 5% stock;
 $\$416.666 - \$400 = \$16.666 +$, in favor of 5% stock
at 60%, *Ans.*
18. $\$11212.50 \div 1.12\frac{1}{2} = \10000 , par value of 5-20's;
 $\$10000 \times .06 = \600 , gold income from 5-20's;
 $\$600 \times 1.06\frac{1}{2} = \641.25 , currency value of income.

19. $\$100 \div .90 = \$111.111 +$, the par value of the 6% bonds that can be purchased for \$100;
 $\$111.111 \times .06 = \6.666 income in currency from 6% bonds;
 $\$100 \div .95 = \105.26 , the par value of the 5% bonds that can be purchased for \$100;
 $\$105.26 \times .05 = \5.263 , income in gold of 5% bonds;
 $\$5.263 \times 1.06\frac{2}{3} = \5.624 , income in currency from 5% bonds.
 $\$6.666 - \$5.624 = \$1.04 +$, in favor of 6% at 90.

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20. $\$13850 \times .05\frac{1}{2} = \761.75 , annual profit of mill;
 $\$13850 \div 1.11\frac{1}{2} = \12421.52 , par value of 10-40's;
 $\$12421.52 \times .05 = \621.076 , gold value of income from 10-40's;
 $\$621.076 \times 1.05 = \652.129 , currency value of income from 10-40's;
 $\$761.75 - 652.129 = \$109.62 +$, diminished, *Ans.*
22. $\$1000 \div .06 = \$16666.66 +$, the par value of 6% stock necessary to produce \$1000, income;
 $91\% + \frac{1}{4}\% = 91\frac{1}{4}\%$; $\$16666.66 \times .91\frac{1}{4} = \$15208.33 +$, the amount of investment, *Ans.*
23. $\$1750 \div .07 = \25000 , par value of stock;
 $\$25000 \times 1.07\frac{1}{4} = \26812.50 , investment, *Ans.*
24. $\$1750 \div .06 = \29166.66 , par value of stock;
 $\$29166.66 \times 1.12\frac{3}{4} = \$32776.04 +$, investment, *Ans.*
25. $\$900 \div .06 = \15000 , or 150 shares of stock;
 $\$84.50 \times 150 = \12675 , investment, *Ans.*

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27. The rate of income is $\frac{7}{105}$, or $\frac{1}{15}$, or $6\frac{2}{3}\%$, of investment.
28. The rate of income is $\frac{11}{110}$, or $\frac{1}{10}$, or 10% , of investment.
29. The income from first is $\frac{8}{125}$, or $6\frac{2}{3}\%$, of investment; the income from second is $\frac{6}{90}$, or $6\frac{2}{3}\%$, of investment; $6\frac{2}{3}\% - 6\frac{2}{3}\% = \frac{4}{15}\%$, in favor of buying 6% bonds at 10% discount, *Ans.*
30. New York 7's yield an income equal to $\frac{7}{105}$, or $6\frac{2}{3}\%$, of the investment; Louisiana 6's yield an income equal to $\frac{6}{90}$, or $6\frac{2}{3}\%$, of the investment; $6\frac{2}{3}\% - 6\frac{2}{3}\% = \frac{8}{147}\%$, in favor of New York 7's at 105, *Ans.*
31. The dividend is $\frac{9}{112}$, or $8\frac{1}{8}\%$, of investment, *Ans.*
33. $.15 \div .07 = 2.14\bar{2}$, or $214\frac{2}{3}\%$, *Ans.*
34. $.10 \div .08 = 1.25$, or 125% , which is 25% premium.
35. $.07 \div .10 = .70$, or, 70% , *Ans.*
36. $.06 \div .07 = .85\bar{7}$, or, $85\frac{5}{7}\%$, *Ans.*
37. 6% stock yields an income of $\frac{6}{90}$, or $6\frac{2}{3}\%$; $.15 \div .06\bar{3} = 2.25$, or 225% , *Ans.*
38. $\$9280 \times 1.07\frac{1}{8} = \9941.20 , *Ans.*
39. $\$7225 \times 1.08\frac{1}{8} = \$7812.03 +$, *Ans.*

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40. $\$5000 \div 1.06\frac{1}{2} = \$4694.84 +$, *Ans.*
41. $\$7250 \div 1.05\frac{1}{4} = \$6888.36 +$, *Ans.*

42. $\$135000 - \$5000 = \$130000$, the entire dividend;
 $\$130000 \div \$2000000 = .06\frac{1}{2}$, or $6\frac{1}{2}\%$, *Ans.*
43. $\$225000 \times .40 = \90000 , the expenses;
 $\$90000 + \$10000 = \$100000$, entire deductions;
 $\$225000 - \$100000 = \$125000$, entire dividend;
 $\$125000 \div \$1500000 = .08\frac{1}{3}$, or $8\frac{1}{3}\%$, the per cent. of dividend.
 Therefore, A. makes $8\frac{1}{3}\%$, or an investment of 75% ,
 or $\frac{7}{8} = 11\frac{1}{8}\%$, *Ans.*
44. $\$150 \times 200 = \30000 , par value of stock;
 $\$30000 \div .98 = \30612.25 +, par value of bonds;
 $\$30000 \times .06 = \1800 , income from stock;
 $30612.25 \times .06 = \$1836.73$ +, income from bonds;
 $\$1836.73 - \$1800 = \$36.73$ +, gain, *Ans.*
45. $\$5000 \times 1.15 = \5750 , market value of U. S. 6's;
 $\$5750 \div 1.05 = \5476.19 +, par value of 10-40's;
 $\$5000 \times .06 = \300 , income from U. S. 6's;
 $\$5476.19 \times .05 = \273.809 , income from U. S. 10-40's;
 $\$300 - \$273.809 = \$26.19$, loss, *Ans.*

INSURANCE.

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2. $\$15000 \times .01\frac{1}{4} = \187.50 , premium, *Ans.*
3. $\$5000 \times .00\frac{3}{4} = \37.50 , prem. for insuring house;
 $\$3000 \times .01 = \30.00 , prem. for insuring furniture;
 $\$67.50$, the entire premium, *Ans.*

4. $\$18000 \times \frac{2}{3} = \12000 , the amount insured;
 $\$1200 \times .02\frac{1}{4} = \270 , premium, *Ans.*
5. $\$80000 + \$65000 = \$145000$, value of ship and cargo;
 $\$145000 \times \frac{2}{3} = \108750 , the sum insured;
 $\$108750 \times .01\frac{1}{4} = \1359.375 , premium, *Ans.*
 $\$108750 - \$1359.375 = \$107390.625$, loss, *Ans.*
6. $\$15850 \times .03\frac{1}{4} = \515.125 , premium, *Ans.*
7. $\$275 \div .00\frac{1}{2} = \55000 , sum insured, *Ans.*
8. $\$325 \div \$16250 = .02$, or 2% , rate of premium, *Ans.*
9. $\$47.50 \div \$9500 = .00\frac{1}{2}$, or $\frac{1}{2}\%$, rate of premium, *Ans.*
10. $\$175 \div .01\frac{1}{4} = \14000 , sum insured, *Ans.*
11. $\$652.50 \div \$43500 = .015$, or $1\frac{1}{2}\%$, rate of prem., *Ans.*
12. $\$180 \div .03 = \6000 , the amount insured;
 $\frac{2}{3}$ of value of mill = $\$6000$
 $\frac{1}{3}$ of value of mill = $\$3000$
 Entire value of mill = $\$9000$, *Ans.*
13. $\$30000 \times \frac{2}{3} = \22500 , sum insured;
 $\$22500 \times .00\frac{1}{4} = \underline{168.75}$, the premium paid;
 $\$22331.25$, loss of insurance co's;
 $\$22500 + \$5000 = \$27500$, secured by merch't;
 $\$30000 - \$27500 = \$2500$, loss goods to merch't;
 $\underline{168.75}$, loss of premium paid;
 $\$2668.75$, entire loss to merch't.

14. $\$400 \div .04\frac{1}{2} = \$8888.88\frac{2}{3}$, the sum insured;

$\frac{2}{3}$ of value of silks = $\$ 8888.88\frac{2}{3}$

$\frac{1}{3}$ of value of silks = $\$ 4444.44\frac{2}{3}$

Entire value of silks = $\$13333.33\frac{1}{3}$, *Ans.*

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15. $\$1657.50 \div .02\frac{1}{2} = \66300 , sum insured;

$\frac{2}{3}$ of value of works = $\$66300$

$\frac{1}{3}$ of value of works = $\$22100$

Entire value of works = $\$88400$, *Ans.*

16. $\$2475 \div .01\frac{1}{4} = \198000 , sum insured;

$\frac{2}{3}$ of value of ship and cargo = $\$198000$

$\frac{1}{3}$ of value of ship and cargo = $\$ 99000$

Entire value of ship and cargo = $\$297000$, *Ans.*

17. $\$225 \div .01\frac{1}{2} = \15000 , sum insured;

$\frac{2}{3}$ of value of store and contents = $\$15000$

$\frac{1}{3}$ of value of store and contents = $\$ 5000$

Entire value of store and contents = $\$20000$

Since the stock was worth half as much as the store, both together were $1\frac{1}{2}$ times the value of the store. Therefore, $\$20000 \div 1\frac{1}{2} = \$13333.33\frac{1}{3}$, the value of store; $\frac{1}{2}$ of $\$13333.33\frac{1}{3} = \$6666.66\frac{2}{3}$, the value of stock, *Ans.*

18. $\$20000 \times \frac{3}{4} = \15000 , the property insured. Since the sum insured is such, that the remainder, after paying $1\frac{1}{2}\%$ premium, is $\$15000$, then $\$15000$ is $98\frac{1}{4}\%$ of the sum covered by insurance; $\$15000 \div .98\frac{1}{4} = \15228.42 , *Ans.*

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2. $\$31.30 \times 3 = \93.90 , annual premium, *Ans.*
3. $\$5500 = 5.5$ thousands. Therefore, $\$26.38 \times 5.5 = \145.09 , annual premium, *Ans.*
4. $\$28.90 \times 5 = \144.50 , annual premium;
 $\$144.50 \times 9 = \1300.50 , entire premiums;
 $\$5000 - \$1300.50 = \$3699.50$, more, *Ans.*
5. $\$22.90 \times 5 = \114.50 , annual premium; $\$114.50 \times 30 = \3435 , entire premium paid. The first payment was on interest for 29 years, the second for 28 years, the third for 27 years, etc., or the entire interest will be the same as the interest of the annual payment for 435 years. $\$114.50 \times .06 = \6.87 , interest for 1 year;
 $\$6.87 \times 435 = \2988.45 , entire interest;
 $\$3435.00$, entire premium;
 $\$6423.45$, payments and interest;
 $\$6423.45 - \$5000 = \$1423.45$, loss, *Ans.*
6. $\$54.90 \times 5 = \274.50 , annual payment; $\$274.50 \times 15 = \4117.50 , entire payments. Since the first payment was on interest 15 years, the second 14 years, etc., the entire interest will be the same as the interest of the annual payment for 120 years. $\$274.50 \times .07 = \19.215 , interest for 1 year;
 $\$19.215 \times 120 = \2305.80 , entire interest;
 $\$4117.50$, entire payments;
 $\$6423.30$, payments and int.;
 $\$6423.30 - \$5000 = \$1423.30$, the loss, *Ans.*

7. $\$50 \times 15 = \750 , amount of premium paid. Since the first payment was made 14 years previous to the accident, the second 13, the third 12, etc., the entire interest will be the same as the interest of the annual payment for $14 + 13 + 12 + 11 + 10 + 9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1 = 105$ years. $\$50 \times .06 = \3 , the interest for 1 year.

$$\$3 \times 105 = \$315, \text{ entire interest;}$$

$$\$750, \text{ entire premium;}$$

$$\$1065, \text{ premium and interest;}$$

$$\$30 \times 20 = \$600, \text{ amount of benefit;}$$

$$\$1065 - \$600 = \$465, \text{ the loss, } \textit{Ans.}$$

EXCHANGE.

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3. $100\% + \frac{1}{2}\% = 100\frac{1}{2}\%$, the rate of exchange;
 $\$1000 \times 1.00\frac{1}{2} = \1005 , cost of draft, *Ans.*
4. $100\% + 1\frac{1}{4}\% = 101\frac{1}{4}\%$, the rate of exchange;
 $\$3000 \times 1.01\frac{1}{4} = \3037.50 , cost of draft, *Ans.*
5. $100\% + \frac{1}{8}\% = 100\frac{1}{8}\%$, the rate of exchange. Therefore, the rate of exchange for a dollar is \$1.00125. The discount on \$1 in Chicago for 33 days is \$.0055. Therefore, $\$1.00125 - \$.0055 = \$.99575$, the cost of \$1 of draft; $\$.99575 \times 5000 = \4978.75 , cost of draft, *Ans.*

6. $\$1 - \$.00125 = \$.99875$, the rate of exchange for $\$1$ of draft;

The discount on $\$1$ in Buffalo for 93 days is $\$.01808\frac{1}{2}$;
 $\$.99875 - \$.01808\frac{1}{2} = \$.98066\frac{3}{4}$, the cost of $\$1$ draft;
 $\$.98066\frac{3}{4} \times 1500 = \1471 , the cost of draft, *Ans.*

7. $\$1 - \$.0025 = \$.9975$, the cost of $\$1$ of draft;
 $\$.9975 \times 5000 = \4987.50 , the cost of draft, *Ans.*

8. $\$1 + \$.00125 = \$1.00125$, the cost of $\$1$ of draft;
 $\$1.00125 \times 3000 = \3003.75 , the cost of draft, *Ans.*

9. $\$1 + \$.00125 = \$1.00125$, the rate of exchange for $\$1$ of draft;

The discount on $\$1$ in Chicago for 93 days is $\$.0155$;
 $\$1.00125 - \$.0155 = \$.98575$, the cost of $\$1$ of draft;
 $\$.98575 \times 5000 = \4928.75 , the cost of draft, *Ans.*

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10. $\$1 + \$.0025 = \$1.0025$, the rate of exchange for $\$1$ of the draft;

The discount on $\$1$ in St. Paul for 60 days is $\$.0116\frac{2}{3}$;
 $\$1.0025 - \$.0116\frac{2}{3} = \$.9908\frac{1}{3}$, the cost of $\$1$ of draft;
 $\$.9908\frac{1}{3} \times 1500 = \1486.25 , the cost of draft, *Ans.*

11. $\$1 + \$.001 = \$1.001$, the rate of exchange for $\$1$ of draft;

The discount on $\$1$ for 63 days in Cincinnati is $\$.0105$;
 $\$1.001 - \$.0105 = \$.9905$, the cost of $\$1$ of draft;
 $\$.9905 \times 5000 = \4952.50 , the cost of draft, *Ans.*

14. $\$1 + \$.0025 = \$1.0025$, the cost of $\$1$ of the draft;
 $\$5725 \div \$1.0025 = \$5710.72 +$, the face of draft, *Ans.*

15. $\$1 + \$.00125 = \$1.00125$, the rate of exchange for \$1 of draft;

The discount on \$1 for 33 days at 6% is \$.0055;

$\$1.00125 - \$.0055 = \$.99575$, the cost of \$1 of draft;

$\$1500 \div \$.99575 = \$1506.40 +$, face of draft, *Ans.*

16. $\$1 + \$.005 = \$1.005$, the rate of exchange for \$1 of draft;

The discount on \$1 for 63 days at 9% is \$.01575;

$\$1.005 - \$.01575 = \$.98925$, the cost of \$1 of draft;

$\$1200 \div \$.98925 = \$1213.04 +$, the face of draft, *Ans.*

17. $\$1 - \$.00125 = \$.99875$, the cost of \$1 of draft;

$\$10000 \div \$.99875 = \$10012.51 +$, face of draft, *Ans.*

18. $\$1 + \$.00125 = \$1.00125$, the rate of exchange for \$1 of draft;

The discount in St. Louis on \$1 for 33 days is \$.0055;

$\$1.00125 - \$.0055 = \$.99575$, the cost of \$1 of draft;

$\$3500 \div \$.99575 = \$3514.93 +$, face of draft, *Ans.*

19. $\$1 + \$.00125 = \$1.00125$, the rate of exchange for \$1 of draft;

$\$1750 \div \$1.00125 = \$1747.81 +$, face of draft, *Ans.*

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3. $\$3762.50 \div 1.05\frac{1}{2} = \3566.35 , value of currency in gold;

$\$3566.35 \div \$4.87 = 732.31 +$, value in pounds sterling;

$\pounds 732.31 = \pounds 732$ 6s. $2\frac{1}{2}$ d., the face of draft, *Ans.*

4. $\$5928.75 \div 1.06\frac{1}{4} = \5580 , value of currency in gold;

$\$5580 \div \$4.85\frac{1}{2} = 1149.33 +$, value in pounds sterling;

$\pounds 1149.33 = \pounds 1149$ 6s. $7\frac{1}{4}$ d., the face of draft, *Ans.*

5. $\$5575.20 \div 1.07\frac{1}{4} = \$5174.1995 +$, value of currency in gold;
 $\$5174.1995 \div \$4.875 = 1061.374 +$, the value in pounds sterling;
 $\pounds 1061.374 = \pounds 1061 \text{ 7s. } 5\frac{1}{4}\text{d.}$, face of draft, *Ans.*
6. $3269 \text{ fr.} \div 5.15 \text{ fr.} = 634.757$, the value in dollars in gold;
 $\$634.757 \times 1.05\frac{3}{8} = \$668.875 +$, cost of draft in currency, *Ans.*
7. $8950 \text{ fr.} \div 5.19 \text{ fr.} = 1724.47 +$, the value in dollars in gold;
 $\$1724.47 \times 1.06\frac{1}{4} = \$1832.249 +$, cost of draft in currency, *Ans.*
8. $\$1575 \div 1.07\frac{1}{4} = \1468.531 , value of currency in gold;
 $5.19 \text{ fr.} \times 1468.531 = 7621.67 \text{ fr.}$, face of draft, *Ans.*
9. $5725 \text{ fr.} \div 5.20 \text{ fr.} = 1100.961 +$, value in dollars in gold;
 $\$1100.961 \times 1.06\frac{1}{4} = \$1169.77 +$, cost of draft, *Ans.*
10. $\pounds 895 \text{ 10s.} = \pounds 895.5$;
 $\$4.87 \times 895.5 = \$4361.085 +$, the gold value of draft;
 $\$4361.085 \times 1.06\frac{1}{8} = \4650.00 , the value of draft, *Ans.*
11. $\pounds 585 \text{ 10s. } 5\text{d.} = \pounds 585.5208 +$;
 $\$4.8665 \times 585.5208 + = \$2849.437 +$, cost in gold;
 $\$2849.437 \times 1.07\frac{1}{2} = \$3063.14 +$, cost of draft in currency, *Ans.*
12. $\pounds 875 \text{ 5s. } 4\text{d.} = \pounds 875.2\frac{2}{3}$;
 $\$4.885 \times 875.2\frac{2}{3} = \4275.678 , cost in gold;
 $\$4275.678 \times 1.04\frac{7}{8} = \$4484.11 +$, *Ans.*

AVERAGE OF PAYMENTS.**Page 292.**

2. \$ 300 \times 0 = —

\$1200 \times 3 = 3600

\$ 800 \times 4 = 3200

\$2300 6800 mo.

6800 mo. \div 2300 = $2\frac{44}{115}$ mo.,
or 2 mo. 29 da., *Ans.*

3. \$ 500 \times 1 = 500

\$ 500 \times 2 = 1000

\$ 800 \times 4 = 3200

\$1800 4700 mo.

4700 mo. \div 1800 = $2\frac{11}{9}$ mo.,
or 2 mo. 18 da., *Ans.*

4. \$1500 \times 0 = —

\$3000 \times 1 = 3000

\$2000 \times 3 = 6000

\$6500 9000 mo.

9000 mo. \div 6500 = $1\frac{5}{13}$ mo.,
or 1 mo. 12 da., *Ans.*

5. \$ 800 \times 1 = 800

\$ 800 \times 2 = 1600

\$ 800 \times 4 = 3200

\$2400 5600 mo.

5600 mo. \div 2400 = $2\frac{1}{3}$ mo.,
or 2 mo. 10 da., *Ans.*

6. \$ 750 \times 2 = 1500

\$ 750 \times 3 = 2250

\$1500 \times 4 = 6000

\$3000 9750 mo.

9750 mo. \div 3000 = $3\frac{1}{4}$ mo.,
or 3 mo. 8 da., *Ans.*

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| | | | | | |
|---------------------------|--------|----------|-----|---|------------|
| 2. Due Mar. 1, 1877 . . . | \$200 | \times | 0 | = | — |
| “ June 10, 1877 . . . | \$500 | \times | 101 | = | 50500 |
| “ June 12, 1877 . . . | \$275 | \times | 103 | = | 28325 |
| “ Sept. 1, 1877 . . . | \$400 | \times | 184 | = | 73600 |
| | | | | | <hr/> |
| | \$1375 | | | | 152425 da. |

$152425 \text{ da.} \div 1375 = 110 + \text{da.}$ Therefore the average time of payment is 111 days after the standard date, March 1, which is June 20, 1877, *Ans.*

| | | | | | |
|---------------------------|--------|----------|-----|---|------------|
| 3. Due Mar. 1, 1877 . . . | \$500 | \times | 0 | = | — |
| “ Apr. 15, 1877 . . . | \$850 | \times | 45 | = | 38250 |
| “ May 20, 1877 . . . | \$375 | \times | 80 | = | 30000 |
| “ June 28, 1877 . . . | \$650 | \times | 119 | = | 77350 |
| | | | | | <hr/> |
| | \$2375 | | | | 145600 da. |

$145600 \text{ da.} \div 2375 = 61 + \text{da.}$ Therefore the average time of payment will be 62 days after the standard date, March 1, which is May 2, 1877, *Ans.*

| | | | | | |
|----------------------------|--------|----------|-----|---|-----------|
| 4. Due Jan. 10, 1877 . . . | \$300 | \times | 26 | = | 7800 |
| “ Apr. 15, 1877 . . . | \$400 | \times | 121 | = | 48400 |
| “ Jan. 1, 1877 . . . | \$750 | \times | 17 | = | 12750 |
| “ Dec. 15, 1876 . . . | \$300 | \times | 0 | = | — |
| | | | | | <hr/> |
| | \$1750 | | | | 68950 da. |

$68950 \text{ da.} \div 1750 = 39 + \text{da.}$ Therefore the average time of payment was 40 days after December 15, 1876, which was January 24, 1877, *Ans.*

| | | |
|---------------------------|---------------|------------------|
| 5. Due Dec. 1, 1876 . . . | \$600 × 0 = | — |
| “ Feb. 3, 1877 . . . | \$400 × 64 = | 25600 |
| “ Dec. 20, 1876 . . . | \$250 × 19 = | 4750 |
| “ Dec. 10, 1876 . . . | \$375 × 9 = | 3375 |
| | <u>\$1625</u> | <u>33725 da.</u> |

33725 da. ÷ 1625 = 20 + da. Therefore the average time of payment was 21 days after December 1, 1876, which was December 22, 1876, *Ans.*

| | | |
|----------------------------|---------------|------------------|
| 6. Due Apr. 10, 1877 . . . | \$460 × 5 = | 2300 |
| “ Apr. 5, 1877 . . . | \$200 × 0 = | — |
| “ May 30, 1877 . . . | \$200 × 55 = | 11000 |
| “ Apr. 25, 1877 . . . | \$900 × 20 = | 18000 |
| | <u>\$1760</u> | <u>31300 da.</u> |

31300 da. ÷ 1760 = 18 da., nearly. Therefore the average time of payment was 18 days after the standard date, April 5, which was April 23, 1877, *Ans.*

| | | |
|---------------------------|---------------|------------------|
| 7. Due May 25, 1877 . . . | \$850 × 10 = | 8500 |
| “ May 15, 1877 . . . | \$600 × 0 = | — |
| “ July 20, 1877 . . . | \$500 × 66 = | 33000 |
| “ June 10, 1877 . . . | \$960 × 26 = | 24960 |
| | <u>\$2910</u> | <u>66460 da.</u> |

66460 da. ÷ 2910 = 22 + da. Therefore the average time of payment was 23 days after the standard date, May 15, which was June 7, 1877, *Ans.*

| | | |
|-----------------|-----------------|---------------------------|
| 8. \$ 600 × 0 = | — | |
| \$ 600 × 2 = | 1200 | 8400 mo. ÷ 2400 = 3½ mo.; |
| \$1200 × 6 = | 7200 | May 1 + 3½ mo. = Aug. |
| <u>\$2400</u> | <u>8400 mo.</u> | 16, 1877, <i>Ans.</i> |

AVERAGE OF ACCOUNTS.**Page 296.**

| 2. Due. | | Amount. | Days. | Product. | Paid. | | Amount. | Days. | Product. |
|----------------|----|----------------|--------------|-----------------|--------------|----|----------------|--------------|-----------------|
| 1877. | | | | | 1877. | | | | |
| Mar. | 5 | \$375 | 117 | 43875 | Jan. | 30 | \$200 | 151 | 30200 |
| Mar. | 15 | 200 | 107 | 21400 | Mar. | 15 | 600 | 107 | 64200 |
| June | 25 | 800 | 5 | 4000 | Apr. | 1 | 200 | 90 | 18000 |
| June | 30 | 450 | 0 | | | | | | |
| | | 1825 | | 69275 | | | \$1000 | | 112400 |
| | | 1000 | | | | | | | 69275 |
| | | 825 | | | | | | | 43125 |

$$43125 \div 825 = 52 + \text{da.};$$

June 30, 1877 + 53 da. = August 22, 1877, *Ans.*

| 3. Due. | | Amount. | Days. | Amount. | Paid. | | Amount. | Days. | Product. |
|----------------|----|----------------|--------------|----------------|--------------|----|----------------|--------------|-----------------|
| 1877. | | | | | 1877. | | | | |
| Mar. | 1 | \$1600 | 92 | 147200 | Mar. | 18 | \$2000 | 75 | 150000 |
| Mar. | 3 | 3800 | 90 | 342000 | May | 23 | 5000 | 9 | 45000 |
| May | 15 | 5500 | 17 | 93500 | | | | | |
| June | 1 | 1500 | 0 | | | | | | 195000 |
| | | \$12400 | | 582700 | | | \$7000 | | |
| | | 7000 | | 195000 | | | | | |
| | | \$5400 | | 387700 | | | | | |

$$387700 \div 5400 = 71 + \text{da.};$$

June 1, 1877 — 72 da. = March 21, 1877, *Ans.*

| 4. Due. | | Amount. | Days. | Product. | Paid. | | Amount. | Days. | Product. |
|---------|----|---------|-------|----------|-------|----|---------|-------|----------|
| 1877. | | | | | 1877. | | | | |
| Apr. | 10 | \$150 | 75 | 11250 | Apr. | 12 | \$250 | 73 | 18250 |
| Apr. | 30 | 400 | 55 | 22000 | May | 1 | 200 | 54 | 10800 |
| May | 16 | 100 | 39 | 3900 | June | 7 | 400 | 17 | 6800 |
| June | 24 | 500 | 0 | | | | | | |
| | | | | | | | \$850 | | 35850 |
| | | \$1150 | | 37150 | | | | | |
| | | 850 | | 35850 | | | | | |
| | | \$300 | | 1300 | | | | | |

$$1300 \div 300 = 4 + \text{da.};$$

June 24, 1877 — 5 da. = June 19, 1877, *Ans.*

| 5. Due. | | Amount. | Days. | Product. | Paid. | | Amount. | Days. | Product. |
|---------|----|---------|-------|----------|-------|----|---------|-------|----------|
| 1877. | | | | | 1877. | | | | |
| Feb. | 1 | \$500 | 183 | 91500 | Feb. | 3 | \$500 | 181 | 90500 |
| Apr. | 20 | 850 | 105 | 89250 | Feb. | 28 | 200 | 156 | 31200 |
| Apr. | 15 | 1500 | 110 | 165000 | June | 18 | 1200 | 46 | 55200 |
| Aug. | 3 | 2500 | | | | | | | |
| | | | | | | | \$1900 | | 176900 |
| | | \$5350 | | 345750 | | | | | |
| | | 1900 | | 176900 | | | | | |
| | | \$3450 | | 168850 | | | | | |

$$168850 \div 3450 = 48 + \text{da.};$$

August 3, 1877 — 49 da. = June 15, 1877, *Ans.*

| 6. Due. | | Amount. | Days. | Product. | Paid. | | Amount. | Days. | Product. |
|---------|----|---------|-------|----------|-------|----|---------|-------|----------|
| 1877. | | | | | 1877. | | | | |
| Feb. | 1 | \$1800 | 183 | 329400 | Feb. | 20 | \$3000 | 164 | 492000 |
| Apr. | 15 | 3000 | 110 | 330000 | July | 21 | 8000 | 13 | 104000 |
| July | 20 | 4800 | 14 | 67200 | | | \$11000 | | 596000 |
| Aug. | 3 | 6000 | 0 | | | | | | |
| | | \$15600 | | 726600 | | | | | |
| | | 11000 | | 596000 | | | | | |
| | | \$4600 | | 130600 | | | | | |

$$130600 \div 4600 = 28 + \text{da.};$$

August 3, 1877 — 29 da. = July 5, 1877, *Ans.*

| 7. Due. | | Amount. | Days. | Product. | Paid. | | Amount. | Days. | Product. |
|---------|----|---------|-------|----------|-------|----|---------|-------|----------|
| 1877. | | | | | 1877. | | | | |
| Sept. | 10 | \$500 | 71 | 35500 | July | 20 | \$400 | 123 | 49200 |
| Nov. | 1 | 700 | 19 | 13300 | Aug. | 20 | 1000 | 92 | 92000 |
| Oct. | 8 | 800 | 43 | 34400 | | | | | 141200 |
| Nov. | 20 | 600 | 0 | | | | \$1400 | | 83200 |
| | | \$2600 | | 83200 | | | | | 58000 |
| | | 1400 | | | | | | | |
| | | \$1200 | | | | | | | |

$58000 \div 1200 = 48 + \text{da.}$ Therefore the debt was due on Nov. 20 + 49 da., or Jan. 8, 1878. The cash balance will be the present worth of \$1200 due in 7 da. @ 6%.

$\$1200 \div 1.001\frac{1}{2} = \$1198.60 +$, the cash balance, *Ans.*

PARTNERSHIP.**Page 300.**

2. $\$7000 + \$7000 + \$6000 = \20000 , entire capital;
 $\frac{7000}{20000}$, or $\frac{7}{20}$, of $\$6000 = \2100 , A's share of gain;
 $\frac{7000}{20000}$, or $\frac{7}{20}$, of $\$6000 = \2100 , B's share of gain;
 $\frac{6000}{20000}$, or $\frac{6}{20}$, of $\$6000 = \1800 , C's share of gain.
3. $\$3000 + \$6000 + \$4000 = \13000 , entire capital;
 $\frac{3000}{13000}$, or $\frac{3}{13}$, of $\$2600 = \600 , A's share of gain;
 $\frac{6000}{13000}$, or $\frac{6}{13}$, of $\$2600 = \1200 , B's share of gain;
 $\frac{4000}{13000}$, or $\frac{4}{13}$, of $\$2600 = \800 , C's share of gain.
4. $\$10000 + \$8000 + \$12000 = \30000 , entire capital;
 $\frac{10000}{30000}$, or $\frac{1}{3}$, of $\$6000 = \2000 , A's share of loss;
 $\frac{8000}{30000}$, or $\frac{8}{30}$, of $\$6000 = \1600 , B's share of loss;
 $\frac{12000}{30000}$, or $\frac{12}{30}$, of $\$6000 = \2400 , C's share of loss.
5. $\$2500 + \$2000 + \$3500 = \8000 , entire capital;
 $\frac{2500}{8000}$, or $\frac{5}{16}$, of $\$640 = \200 , A's share of loss;
 $\frac{2000}{8000}$, or $\frac{1}{4}$, of $\$640 = \160 , B's share of loss;
 $\frac{3500}{8000}$, or $\frac{7}{16}$, of $\$640 = \280 , C's share of loss.
6. $\$8000 + \$10000 + \$9000 + \$13000 = \$40000$, entire capital;
 $\frac{8000}{40000}$, or $\frac{1}{5}$, of $\$3000 = \600 , A's share of gain;
 $\frac{10000}{40000}$, or $\frac{1}{4}$, of $\$3000 = \750 , B's share of gain;
 $\frac{9000}{40000}$, or $\frac{9}{40}$, of $\$3000 = \675 , C's share of gain;
 $\frac{13000}{40000}$, or $\frac{13}{40}$, of $\$3000 = \975 , D's share of gain.

7. $\$8000 + \$10000 = \$18000$, capital of D & G;
 $\frac{1}{3}$ of $\$5400 = \1800 , L's gain;
 $\$5400 - \$1800 = \$3600$, gain of D & G;
 $\frac{\$8000}{\$18000}$ or $\frac{4}{9}$ of $\$3600 = \1600 , D's gain;
 $\frac{\$10000}{\$18000}$ or $\frac{5}{9}$ of $\$3600 = \2000 , G's gain.
8. $\frac{3}{8}$ of $\$46000 = \17250 , furnished by E;
 $\$17250 + \$11500 = \$28750$, furnished by E & F;
 $\$46000 - \$28750 = \$17250$, furnished by G;
 $\$48300 - \$46000 = \$2300$, entire gain;
 $\frac{\$17250}{\$23000}$ or $\frac{3}{4}$ of $\$2300 = \862.50 , E's share of gain;
 $\frac{\$11500}{\$23000}$ or $\frac{1}{2}$ of $\$2300 = \575 , F's share of gain;
 $\frac{\$48300}{\$23000}$ or $\frac{3}{8}$ of $\$2300 = \862.50 , G's share of gain.
9. $\$6470 + \$5420 + \$3410 = \15300 , entire capital;
 $\frac{\$6470}{\$15300}$ of $\$6490.75 = \$2744.78 +$, A's share of gain;
 $\frac{\$5420}{\$15300}$ of $\$6490.75 = \$2299.33 +$, B's share of gain;
 $\frac{\$3410}{\$15300}$ of $\$6490.75 = \$1446.63 +$, C's share of gain.
10. $125 \text{ A. } 60 \text{ sq. rd.} = 125.375 \text{ A.};$
 $\$3.75 \times 125.375 = \$470.156 +$, expense of pasture;
 $125 + 145 + 175 + 340 = 785$, number of sheep;
 $\frac{125}{785}$ of $\$470.156 = \$74.86 +$, am't A should pay;
 $\frac{145}{785}$ of $\$470.156 = \$86.84 +$, am't B should pay;
 $\frac{175}{785}$ of $\$470.156 = \$104.81 -$, am't C should pay;
 $\frac{340}{785}$ of $\$470.156 = \$203.63 -$, am't D should pay.

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11. Since the entire gain was $\$4200$, and C's gain was $\$1400$, or $\frac{1}{3}$ of the entire gain, C's stock was $\frac{1}{3}$ of the entire stock, or $\frac{1}{2}$ as much as A's and B's together;

$$\begin{aligned}
 \$6000 + \$8000 &= \$14000, \text{ A's and B's stock;} \\
 \frac{1}{2} \text{ of } \$14000 &= \$7000, \text{ C's stock;} \\
 \$4200 - \$1400 &= \$2800, \text{ A's and B's gain;} \\
 \frac{\$2800}{14000}, \text{ or } \frac{2}{14}, \text{ of } \$2800 &= \$1200, \text{ A's gain;} \\
 \frac{\$2800}{14000}, \text{ or } \frac{2}{14}, \text{ of } \$2800 &= \$1600, \text{ B's gain, Ans.}
 \end{aligned}$$

$$12. \$500 + \$600 + \$800 + \$1000 + \$1200 = \$4100, \text{ entire capital;}$$

$$\begin{aligned}
 \frac{\$4100}{4100}, \text{ or } \frac{5}{41}, \text{ of } \$2750 &= \$335.365 +, \text{ A's gain;} \\
 \frac{\$4100}{4100}, \text{ or } \frac{6}{41}, \text{ of } \$2750 &= \$402.439 +, \text{ B's gain;} \\
 \frac{\$4100}{4100}, \text{ or } \frac{8}{41}, \text{ of } \$2750 &= \$536.585 +, \text{ C's gain;} \\
 \frac{\$4100}{4100}, \text{ or } \frac{10}{41}, \text{ of } \$2750 &= \$670.731 +, \text{ D's gain;} \\
 \frac{\$4100}{4100}, \text{ or } \frac{12}{41}, \text{ of } \$2750 &= \$804.878 +, \text{ E's gain, Ans.}
 \end{aligned}$$

$$13. \text{ Since A paid } \frac{1}{4} \text{ of the purchase money, he should receive } \frac{1}{4} \text{ of the gain; since B paid } \frac{1}{8} \text{ of the purchase money, he should receive } \frac{1}{8} \text{ of the gain; since C paid the rest, or } \frac{5}{12}, \text{ of the purchase money, he should receive } \frac{5}{12} \text{ of the gain.}$$

$$\begin{aligned}
 \frac{1}{4} \text{ of } \$3000 &= \$750, \text{ A's gain;} \\
 \frac{1}{8} \text{ of } \$3000 &= \$1000, \text{ B's gain;} \\
 \frac{5}{12} \text{ of } \$3000 &= \$1250, \text{ C's gain, Ans.}
 \end{aligned}$$

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$$\begin{aligned}
 2. \$4000 \times 18 &= \$72000 = \text{A's capital for 1 mo.;} \\
 \$6000 \times 15 &= \$90000 = \text{B's capital for 1 mo.;} \\
 \$8000 \times 9 &= \$72000 = \text{C's capital for 1 mo.;} \\
 &\underline{\$234000} = \text{entire capital for 1 mo.}
 \end{aligned}$$

$$\begin{aligned}
 \frac{\$72000}{234000} \text{ or } \frac{4}{13} \text{ of } \$9360 &= \$2880, \text{ A's gain;} \\
 \frac{\$90000}{234000} \text{ or } \frac{5}{13} \text{ of } \$9360 &= \$3600, \text{ B's gain;} \\
 \frac{\$72000}{234000} \text{ or } \frac{4}{13} \text{ of } \$9360 &= \$2880, \text{ C's gain, Ans.}
 \end{aligned}$$

3. $\$4000 \times 8 = \$32000 = \text{A's capital for 1 mo.};$
 $\$6000 \times 7 = \$42000 = \text{B's capital for 1 mo.};$
 $\$3500 \times 12 = \$42000 = \text{C's capital for 1 mo.};$

 $\$116000 = \text{entire capital for 1 mo.}$

$\frac{\$22000}{\$116000}$ or $\frac{8}{29}$ of $\$2320 = \640 , A's gain;
 $\frac{\$22000}{\$116000}$ or $\frac{7}{29}$ of $\$2320 = \840 , B's gain;
 $\frac{\$22000}{\$116000}$ or $\frac{11}{29}$ of $\$2320 = \840 , C's gain, *Ans.*

4. $20\% \text{ of } \$5875 = \1175 , B's capital;
 $35\% \text{ of } \$5875 = \2056.25 , C's capital;
 $45\% \text{ of } \$5875 = \2643.75 , D's capital.

$\$1175 \times 15 = \17625.00 , B's capital for 1 mo.;
 $\$2056.25 \times 9 = \18506.25 , C's capital for 1 mo.;
 $\$2643.75 \times 10 = \26437.50 , D's capital for 1 mo.;

$\$62568.75$, entire capital for 1 mo.

$\$2502.75 \div \$62568.75 = .04$; or the loss is 4% of the capital for 1 mo.;

4% of $\$17625.00 = \705 , B's loss;
 4% of $\$18506.25 = \740.25 , C's loss;
 4% of $\$26437.50 = \1057.50 , D's loss, *Ans.*

5. 20 men for 3 mo. = 60 men for 1 mo., A's men;
 25 men for $3\frac{1}{2}$ mo. = $87\frac{1}{2}$ men for 1 mo., B's men;
 15 men for 4 mo. = 60 men for 1 mo., C's men;

 Entire No. of men = $207\frac{1}{2}$ men for 1 mo.

$\$1475 \div 207\frac{1}{2} = \$7.1084 +$, profit for 1 man 1 mo.;
 $\$7.1084 \times 60 = \$426.50 +$, A's profit;
 $\$7.1084 \times 87\frac{1}{2} = \$621.98 +$, B's profit;
 $\$7.1084 \times 60 = \$426.50 +$, C's profit, *Ans.*

$$\begin{aligned}
 6. \quad & \$5000 \times 12 = \$60000 = \text{A's capital for 1 mo.;} \\
 & \$8000 \times 10 = \$80000 = \text{B's capital for 1 mo.;} \\
 & \$10000 \times 6 = \$60000 = \text{C's capital for 1 mo.;} \\
 & \qquad \qquad \qquad \underline{\hspace{1.5cm}} \\
 & \qquad \qquad \qquad \$200000 = \text{entire capital for 1 mo.}
 \end{aligned}$$

$$\frac{\$60000}{\$200000}, \text{ or } \frac{3}{10}, \text{ of } \$8500 = \$2550 = \text{A's loss;}$$

$$\frac{\$80000}{\$200000}, \text{ or } \frac{4}{10}, \text{ of } \$8500 = \$3400 = \text{B's loss;}$$

$$\frac{\$60000}{\$200000}, \text{ or } \frac{3}{10}, \text{ of } \$8500 = \$2550 = \text{C's loss.}$$

$$\begin{aligned}
 7. \quad & \$4500 \times 6 = \$27000 = \text{A's capital for 1 mo.;} \\
 & \$5000 \times 8 = \$40000 = \text{B's capital for 1 mo.;} \\
 & \$6500 \times 7 = \$45500 = \text{C's capital for 1 mo.;} \\
 & \qquad \qquad \qquad \underline{\hspace{1.5cm}} \\
 & \qquad \qquad \qquad \$112500 = \text{entire capital for 1 mo.}
 \end{aligned}$$

$$\$4500 \div \$112500 = .04; \text{ or gain is 4\% of capital for 1 mo.;}$$

$$4\% \text{ of } \$27000 = \$1080, \text{ A's gain;}$$

$$4\% \text{ of } \$40000 = \$1600, \text{ B's gain;}$$

$$4\% \text{ of } \$45500 = \$1820, \text{ C's gain.}$$

$$\begin{aligned}
 8. \quad & \$1200 \times 12 = \$14400 = \text{G's capital for 1 mo.;} \\
 & \$1500 \times 12 = \$18000 = \text{L's capital for 1 mo.;} \\
 & \$3000 \times 6 = \$18000 \quad \left. \vphantom{\begin{array}{l} \$3000 \times 6 \\ \$1000 \times 6 \end{array}} \right\} = \text{F's capital for 1 mo.;} \\
 & \$1000 \times 6 = \$6000 \quad \left. \vphantom{\begin{array}{l} \$3000 \times 6 \\ \$1000 \times 6 \end{array}} \right\} \\
 & \qquad \qquad \qquad \underline{\hspace{1.5cm}} \\
 & \qquad \qquad \qquad \$56400 = \text{entire capital for 1 mo.}
 \end{aligned}$$

$$\frac{\$14400}{\$56400}, \text{ or } \frac{12}{47}, \text{ of } \$2200 = \$561.702 +, \text{ G's profits;}$$

$$\frac{\$18000}{\$56400}, \text{ or } \frac{15}{47}, \text{ of } \$2200 = \$702.127 +, \text{ L's profits;}$$

$$\frac{\$18000}{\$56400}, \text{ or } \frac{15}{47}, \text{ of } \$2200 = \$936.170 +, \text{ F's profits.}$$

SIMPLE PROPORTION.**Page 310.**

3. 6 men : 10 men :: \$75 : ();

$$\frac{\$75 \times 10}{6} = \$125, \text{ Ans.}$$

4. 16 yd. : 7 yd. :: \$20 : ();

$$\frac{\$20 \times 7}{16} = \$8.75, \text{ Ans.}$$

5. 45 sheep : 18 sheep :: \$112.50 : ();

$$\frac{\$112.50 \times 18}{45} = \$45, \text{ Ans.}$$

6. 8 horses : 14 horses :: 15 tons : ();

$$\frac{15 \text{ tons} \times 14}{8} = 26\frac{1}{4} \text{ tons, Ans.}$$

7. 6 men : 11 men :: () : 45 da.;

$$\frac{45 \text{ da.} \times 6}{11} = 24\frac{6}{11} \text{ da., Ans.}$$

8. 10 men : 13 men :: () : 6 da.;

$$\frac{6 \text{ da.} \times 10}{13} = 4\frac{8}{13} \text{ da., Ans.}$$

9. 8 men : () :: 40 rd. : 60 rd.;

$$\frac{8 \text{ men} \times 60}{40} = 12 \text{ men, Ans.}$$

10. 13 men : 8 men :: 15 da. : ();

$$\frac{15 \text{ da.} \times 8}{13} = 9\frac{3}{13} \text{ da., Ans.}$$

11. 6 bu. : () :: \$7.32 : \$45;

$$\frac{6 \text{ bu.} \times 45}{7.32} = 36\frac{4}{11} \text{ bu., Ans.}$$

12. 15 bbl. : () :: \$33.75 : \$2250;

$$\frac{15 \text{ bbl.} \times 2250}{33.75} = 1000 \text{ bbl., Ans.}$$

13. 9 men : 13 men :: 28 da. : ();

$$\frac{28 \text{ da.} \times 13}{9} = 40\frac{4}{9} \text{ da., Ans.}$$

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14. $1\frac{1}{8}$ acres : $3\frac{1}{4}$ acres :: 165 bu. : ();

$$\frac{165 \text{ bu.} \times 3\frac{1}{4}}{1\frac{1}{8}} = 520 \text{ bu., Ans.}$$

15. 405 bu. : 975 bu. :: $1\frac{1}{8}$: ();

$$\frac{975 \text{ bu.} \times 1\frac{1}{8}}{405} = 2\frac{1}{4} \text{ acres, Ans.}$$

16. 5 horses : 13 horses :: \$626.25 : () ;

$$\frac{\$626.25 \times 13}{5} = \$1628.25, \text{ Ans.}$$

17. 26 men : 32 men :: () : 80 da. ;

$$\frac{80 \text{ da.} \times 26}{32} = 65 \text{ da., Ans.}$$

18. 9 horses : 7 horses :: 12590 lb. : () ;

$$\frac{12590 \text{ lb.} \times 7}{9} = 9792\frac{2}{3} \text{ lb., Ans.}$$

19. $6\frac{1}{2}$ da. : 5 da. :: () : 1775 mi. ;

$$\frac{1775 \text{ mi.} \times 6\frac{1}{2}}{5} = 2307\frac{1}{2} \text{ mi., Ans.}$$

20. $3\frac{1}{2}$ hr. : $5\frac{7}{8}$ hr. :: $96\frac{3}{4}$ mi. : () ;

$$\frac{96\frac{3}{4} \text{ mi.} \times 5\frac{7}{8}}{3\frac{1}{2}} = 162\frac{45}{112} \text{ mi., Ans.}$$

21. The dog gains 2 rods of every 19 rods which he runs.
Therefore,

$$2 \text{ rd.} : 45 \text{ rd.} :: 19 \text{ rds.} : () ;$$

$$\frac{45 \text{ rd.} \times 19}{2} = 427\frac{1}{2} \text{ rd., Ans.}$$

22. They will all together fill $\frac{1}{12} + \frac{1}{18} + \frac{1}{18}$, or $\frac{29}{144}$, of the cistern in 1 hour. Therefore,

$$\frac{29}{144} \text{ of cistern} : \frac{144}{29} \text{ of cistern} :: 1 \text{ hr.} : () ; \text{ or,}$$

$\frac{29}{144}$ of cistern : 1 cistern :: 1 hr. : () ;

$$\frac{1 \text{ hr.} \times 1}{\frac{29}{144}} = \frac{144}{29} = 4\frac{8}{29} \text{ hr., Ans.}$$

23. 15 da. : () :: 675 pages : 900 pages ;

$$\frac{15 \text{ da.} \times 900}{675} = 20 \text{ da., Ans.}$$

COMPOUND PROPORTION.

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2. 20 men : 15 men } :: 45 da. : () ;
 12 hr. : 10 hr. }

$$\frac{45 \times 15 \times 10}{12 \times 20} = 28\frac{1}{2} \text{ da., Ans.}$$

3. 6 ft. : 9 ft. }
 3 ft. : 4 ft. } :: 5940 lb. : () ;
 2 ft. : 3 ft. }

$$\frac{5940 \times 9 \times 4 \times 3}{6 \times 3 \times 2} = 17820 \text{ lb., Ans.}$$

4. \$135 : \$275 } :: \$1500 : () ;
 8 mo. : 18 mo. }

$$\frac{1500 \times 275 \times 18}{135 \times 8} = \$6875, \text{ Ans.}$$

5. 5 grown persons and 3 children = $6\frac{1}{2}$ grown persons;
 8 grown persons and 6 children = 11 grown persons;

$$\left. \begin{array}{l} 6\frac{1}{2} : 11 \\ 3 \text{ wk.} : 7 \text{ wk.} \end{array} \right\} :: \$180 : ();$$

$$\frac{180 \times 11 \times 7}{6\frac{1}{2} \times 3} = \$710.76 +, \text{ Ans.}$$

6. $\left. \begin{array}{l} 25 \text{ men} : 20 \text{ men} \\ 10 \text{ hr.} : 8 \text{ hr.} \\ 65 \text{ ft.} : 75 \text{ ft.} \\ 9 \text{ ft.} : 8 \text{ ft.} \\ 6 \text{ ft.} : 7 \text{ ft.} \end{array} \right\} :: 25 \text{ da.} : ();$

$$\frac{25 \times 20 \times 8 \times 75 \times 8 \times 7}{25 \times 10 \times 65 \times 9 \times 6} = 19\frac{17}{117} \text{ da., Ans.}$$

Example 6, stated by *cause and effect*, is as follows:

| 1st cause. | 2d cause. | 1st effect. | 2d effect. |
|------------|-----------|--------------|--------------|
| 20 men | 25 men | 65 ft. long | 75 ft. long. |
| 8 hr. | 10 hr. | 9 ft. wide : | 8 ft. wide. |
| 25 da. | () da. | 6 ft. deep | 7 ft. deep. |

7. $\left. \begin{array}{l} 16 \text{ persons} : 9 \text{ persons} \\ 5 \text{ wk.} : 22 \text{ wk.} \end{array} \right\} :: \$240 : ();$

$$\frac{240 \times 9 \times 22}{16 \times 5} = \$594, \text{ Ans.}$$

8. Since \$800 gains \$80 in 15 mo., to find the interest for
 1 yr. the following proportion is used:

$$15 \text{ mo.} : 12 \text{ mo.} :: \$80 : ();$$

$$\frac{\$80 \times 12}{15} = \$64, \text{ the interest for 1 yr.}$$

At 1%, the interest of \$800 for 1 yr. is \$8. Therefore,
 $\$8 : \$64 :: 1\% : 8\%$, rate of interest. Since
 \$975 is the amount for 1 yr. at 8%,

$$108\% : 100\% :: \$975 : ();$$

$$\frac{975 \times 100}{108} = \$902.77 +, \text{ Ans.}$$

$$9. \left. \begin{array}{l} 75 : 215 \\ \frac{3}{4} \text{ yd.} : \frac{3}{4} \text{ yd.} \end{array} \right\} :: 275 \text{ yd.} : ();$$

$$\frac{275 \times 215 \times \frac{3}{4}}{75 \times \frac{3}{4}} = 473 \text{ yd., Ans.}$$

$$10. \left. \begin{array}{l} 8 \text{ ft.} : 14 \text{ ft.} \\ 6 \text{ ft.} : 8 \text{ ft.} \\ 8 \text{ ft.} : 9 \text{ ft.} \end{array} \right\} :: 309 \text{ bu.} : ();$$

$$\frac{309 \times 14 \times 8 \times 9}{8 \times 6 \times 8} = 811\frac{1}{8} \text{ bu., Ans.}$$

$$11. \left. \begin{array}{l} 13 \text{ men} : 15 \text{ men} \\ 8 \text{ hr.} : 10 \text{ hr.} \end{array} \right\} :: 18 \text{ da.} : ();$$

$$\frac{18 \times 15 \times 10}{13 \times 8} = 25\frac{15}{8} \text{ da., Ans.}$$

$$12. \left. \begin{array}{l} 16 \text{ horses} : 12 \text{ horses} \\ 40 \text{ bu.} : 140 \text{ bu.} \end{array} \right\} :: 8 \text{ da.} : ();$$

$$\frac{8 \times 12 \times 140}{16 \times 40} = 21 \text{ da., Ans.}$$

$$13. \left. \begin{array}{l} 1 \text{ reg.} : 3 \text{ reg.} \\ 15 \text{ da.} : 12 \text{ da.} \end{array} \right\} :: 11500 \text{ lb.} : ();$$

$$\frac{11500 \times 3 \times 12}{15} = 27600 \text{ lb., } \textit{Ans.}$$

$$14. \left. \begin{array}{l} 8 \text{ ft.} : 10 \text{ ft.} \\ 4 \text{ ft.} : 5 \text{ ft.} \\ 5 \text{ ft.} : 6 \text{ ft.} \end{array} \right\} :: 10000 \text{ lb.} : ();$$

$$\frac{10000 \times 10 \times 5 \times 6}{8 \times 4 \times 5} = 18750 \text{ lb., } \textit{Ans.}$$

15. Since 5 horses eat as much as 6 cattle, 8 horses and 12 cattle eat as much as 18 horses, and 7 horses and 15 cattle eat as much as $19\frac{1}{2}$ horses. Therefore,

$$\left. \begin{array}{l} 18 \text{ horses} : 19\frac{1}{2} \text{ horses} \\ 40 \text{ da.} : 65 \text{ da.} \end{array} \right\} :: 12 \text{ tons.} : ();$$

$$\frac{12 \times 19\frac{1}{2} \times 65}{18 \times 40} = 21\frac{1}{8} \text{ tons, } \textit{Ans.}$$

$$16. \left. \begin{array}{l} 25 \text{ men} : 15 \text{ men} \\ 8 \text{ hr.} : 6 \text{ hr.} \\ 80 \text{ ft.} : 120 \text{ ft.} \\ 60 \text{ ft.} : 70 \text{ ft.} \\ 10 \text{ ft.} : 8 \text{ ft.} \end{array} \right\} :: 25 \text{ da.} : ();$$

$$\frac{25 \times 15 \times 6 \times 120 \times 70 \times 8}{25 \times 8 \times 80 \times 60 \times 10} = 15\frac{3}{4} \text{ da., } \textit{Ans.}$$

$$17. \left. \begin{array}{l} 52 \text{ men} : 45 \text{ men} \\ 45 \text{ ft.} : 60 \text{ ft.} \\ 10 \text{ ft.} : 8 \text{ ft.} \\ 15 \text{ da.} : 25 \text{ da.} \end{array} \right\} :: 355 \text{ ft.} : ();$$

$$\frac{355 \times 45 \times 60 \times 8 \times 25}{52 \times 45 \times 10 \times 15} = 546\frac{2}{3} \text{ ft., } Ans.$$

INVOLUTION.**Page 317.**

2. $54^2 = 50^2 + 2(50 \times 4) + 4^2 = 2916, Ans.$
3. $71^2 = 70^2 + 2(70 \times 1) + 1^2 = 5041, Ans.$
4. $68^2 = 60^2 + 2(60 \times 8) + 8^2 = 4624, Ans.$
5. $47^2 = 40^2 + 2(40 \times 7) + 7^2 = 2209, Ans.$
6. $89^2 = 80^2 + 2(80 \times 9) + 9^2 = 7921, Ans.$
7. $26^2 = 20^2 + 2(20 \times 6) + 6^2 = 676, Ans.$
8. $74^2 = 70^2 + 2(70 \times 4) + 4^2 = 5476, Ans.$
9. $95^2 = 90^2 + 2(90 \times 5) + 5^2 = 9025, Ans.$
10. $82^2 = 80^2 + 2(80 \times 2) + 2^2 = 6724, Ans.$
11. $39^2 = 30^2 + 2(30 \times 9) + 9^2 = 1521, Ans.$
12. $44^2 = 40^2 + 2(40 \times 4) + 4^2 = 1936, Ans.$
13. $67^2 = 60^2 + 2(60 \times 7) + 7^2 = 4489, Ans.$
14. $16^2 = 9^2 + 2(9 \times 7) + 7^2 = 256, Ans.$

$$15. 20^3 = 12^3 + 2(12 \times 8) + 8^3 = 400, \text{ Ans.}$$

$$16. 32^3 = 30^3 + 2(30 \times 2) + 2^3 = 1024, \text{ Ans.}$$

$$17. 13^3 = 7^3 + 2(7 \times 6) + 6^3 = 169, \text{ Ans.}$$

$$18. 26^3 = 9^3 + 2(9 \times 17) + 17^3 = 676, \text{ Ans.}$$

$$19. 17^3 = 8^3 + 2(8 \times 9) + 9^3 = 289, \text{ Ans.}$$

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$$2. 26^3 = 20^3 + 3(20^2 \times 6) + 3(20 \times 6^2) + 6^3 = 17576.$$

$$3. 31^3 = 30^3 + 3(30^2 \times 1) + 3(30 \times 1^2) + 1^3 = 29791.$$

$$4. 28^3 = 20^3 + 3(20^2 \times 8) + 3(20 \times 8^2) + 8^3 = 21952.$$

$$5. 42^3 = 40^3 + 3(40^2 \times 2) + 3(40 \times 2^2) + 2^3 = 74088.$$

$$6. 27^3 = 20^3 + 3(20^2 \times 7) + 3(20 \times 7^2) + 7^3 = 19683.$$

$$7. 36^3 = 30^3 + 3(30^2 \times 6) + 3(30 \times 6^2) + 6^3 = 46656.$$

$$8. 38^3 = 30^3 + 3(30^2 \times 8) + 3(30 \times 8^2) + 8^3 = 54872.$$

$$9. 39^3 = 30^3 + 3(30^2 \times 9) + 3(30 \times 9^2) + 9^3 = 59319.$$

$$10. 54^3 = 50^3 + 3(50^2 \times 4) + 3(50 \times 4^2) + 4^3 = 157464.$$

$$11. 52^3 = 50^3 + 3(50^2 \times 2) + 3(50 \times 2^2) + 2^3 = 140608.$$

$$12. \left. \begin{aligned} 64^3 &= 60^3 + 3(60^2 \times 4) + 3(60 \times 4^2) + 4^3, \text{ or} \\ &48^3 + 3(48^2 \times 16) + 3(48 \times 16^2) + 16^3, \text{ or} \\ &35^3 + 3(35^2 \times 29) + 3(35 \times 29^2) + 29^3, \text{ etc.} \end{aligned} \right\} 262144.$$

$$\begin{array}{l}
 13. \quad 66^3 = 60^3 + 3(60^2 \times 6) + 3(60 \times 6^2) + 6^3, \text{ or} \\
 \quad \quad 52^3 + 3(52^2 \times 14) + 3(52 \times 14^2) + 14^3, \text{ or} \\
 \quad \quad 40^3 + 3(40^2 \times 26) + 3(40 \times 26^2) + 26^3, \text{ etc.} \quad \left. \vphantom{\begin{array}{l} 66^3 \\ 52^3 \\ 40^3 \end{array}} \right\} 287496.
 \end{array}$$

EVOLUTION.

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2. The prime factors of 144 are 2, 2, 2, 2, 3, 3. Since the square root is sought, they are to be separated into *two* equal groups. Therefore the square root of 144 is $2 \times 2 \times 3$, or 12, *Ans.*

The prime factors of 256 are 2, 2, 2, 2, 2, 2, 2, 2. Therefore the square root of 256 is $2 \times 2 \times 2 \times 2 = 16$, *Ans.*

The prime factors of 324 are 2, 2, 3, 3, 3, 3. Therefore the square root of 324 is $2 \times 3 \times 3 = 18$, *Ans.*

The prime factors of 576 are 2, 2, 2, 2, 2, 2, 3, 3. Therefore the square root of 576 is $2 \times 2 \times 2 \times 3 = 24$, *Ans.*

3. The prime factors of 64 are 2, 2, 2, 2, 2, 2. Since the cube root is sought, they are to be separated into *three* equal groups. Therefore the cube root of 64 is $2 \times 2 = 4$, *Ans.*

The prime factors of 512 are 2, 2, 2, 2, 2, 2, 2, 2, 2. Therefore the cube root of 512 is $2 \times 2 \times 2 = 8$, *Ans.*

The prime factors of 4096 are 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2. Therefore the cube root of 4096 is $2 \times 2 \times 2 \times 2 = 16$, *Ans.*

The prime factors of 13824 are 2, 2, 2, 2, 2, 2, 2, 2, 2, 3, 3, 3. Therefore the cube root of 13824 is $2 \times 2 \times 2 \times 3 = 24$, *Ans.*

4. The prime factors of 1296 are 2, 2, 2, 2, 3, 3, 3, 3. Therefore the *fourth* root is $2 \times 3 = 6$, *Ans.*

The prime factors of 248832 are 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3. Therefore the *fifth* root of 248832 is $2 \times 2 \times 3 = 12$, *Ans.*

SQUARE ROOT.

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22. $\frac{1}{2} = .5$. To extract the square root of .5, ciphers must be annexed and the square root extracted.

.50·00·00· (.707 +, *Ans.*

49

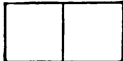

$$\begin{array}{r} 1407 \overline{) 10000} \\ \underline{9849} \end{array}$$

25. .9 = .90·00·00 (.948 +, *Ans.*

81

$$\begin{array}{r} 184 \overline{) 900} \\ \underline{736} \\ 1888 \overline{) 16400} \\ \underline{15104} \end{array}$$

APPLICATIONS OF SQUARE ROOT.**Page 325.**

1. $\sqrt{625}$ sq. ft. = 25 ft., *Ans.*
2. $\sqrt{2025}$ sq. rd. = 45 rd., *Ans.*
3. $\frac{1}{4}$ of 5408 sq. ft. is 2704 sq. ft., area of each square;
 $\sqrt{2704} = 52$, the side of square or width
of rectangle;
2 times 52, or 104, is the length of rectangle, *Ans.*

4. Since one field contains 4 times as much as the other,
one will contain $\frac{1}{5}$ of 50 A. and the other $\frac{4}{5}$ of 50 A.;
 $\frac{1}{5}$ of 50 A. = 10 A.; $\frac{4}{5}$ of 50 A. = 40 A.;
10 A. \times 160 = 1600 sq. rd., the area of smaller field;
 $\sqrt{1600}$ sq. rd. = 40 rd., the side of smaller field;
 $40 \times 4 = 160$, rods of fence needed for smaller field;
40 A. \times 160 = 6400 sq. rd., the area of larger field;
 $\sqrt{6400}$ sq. rd. = 80 rd., the side of larger field;
 $4 \times 80 = 320$, rods of fence needed for larger field;
 $160 + 320 = 480$, rods of fence for both fields, *Ans.*
5. Since the length is twice the width, if it is divided into
two equal fields, each containing 10
acres, each will be a square whose side
is half the length of the rectangle;
10 A. \times 160 = 1600 sq. rd., the area of
each square;


$\sqrt{1600}$ sq. rd. = 40 rd., the side of square and width of the rectangle.

Since the length was twice the width, the length will be $40 \times 2 = 80$ rd. The distance around it, therefore, is 240 rd., *Ans.*

6. $72 \times 32 = 2304$ sq. rd., the area of the field ;

$\sqrt{2304} = 48$ rd., the side of an equal square field ;

$48 \text{ rd.} \times 4 = 192$ rd., the distance around square field ;

$2(72 + 32) = 208$ rd., the distance around rectangular field ;

$208 \text{ rd.} - 192 \text{ rd.} = 16$ rd., the distance shorter around square field ;

$\$572 \div 208 = \2.75 , the price of fence per rd. ;

$\$2.75 \times 16 = \44 , am't less in form of a square, *Ans.*

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2. $\sqrt{15^2 + 20^2} = 25$ ft., the hypotenuse, *Ans.*

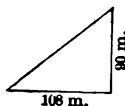
3. $\sqrt{120^2 - 40^2} = 113.137 +$ ft., the perpendicular, *Ans.*

4. $\sqrt{50^2 - 30^2} = 40$ ft., the base, *Ans.*

5. Since the part broken off, or hypotenuse, was 125 ft., the part standing, or perpendicular, was 25 ft. Therefore,

$\sqrt{125^2 - 25^2} = 122.474 +$ ft., width of stream, *Ans.*

6. In 6 hours, the first had traveled 90 miles, the second 108 miles. The distance they are apart is the hypotenuse of a right-angled triangle, whose sides are respectively 108 and 90 miles ;



$\sqrt{108^2 + 90^2} = 140.584 +$ mi., the distance apart, *Ans.*

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7. The walk is the hypotenuse of a right-angled triangle whose sides are respectively 45 and 60 rd.;

$$\sqrt{45^2 + 60^2} = 75 \text{ rd.}, \text{ the length of walk, } \textit{Ans.}$$

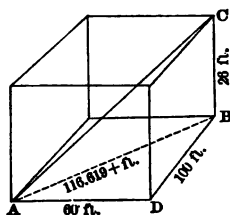
8. The angle A D B is a right angle. Therefore,

$$\sqrt{60^2 + 100^2} = 116.619 + \text{ft.},$$

the distance A B.

- The angle A B C is a right angle. Therefore,

$$\sqrt{116.619^2 + 26^2} = 119.482 + \text{ft.}, \text{ the distance A C, } \textit{Ans.}$$

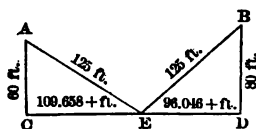


9. $\sqrt{125^2 - 60^2} = 109.658 + \text{ft.},$
the distance C E;

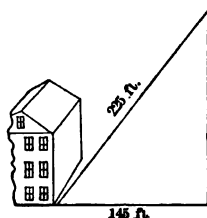
$$\sqrt{125^2 - 80^2} = 96.046 + \text{ft.},$$

the distance E D;

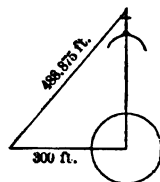
$$109.658 \text{ ft.} + 96.046 \text{ ft.} = 205.704 + \text{ft.}, \text{ the distance CD, width of the street.}$$



10. $\sqrt{225^2 - 145^2} = 172.046 + \text{ft.},$
the height of the pole, *Ans.*



11. 488 ft. 10½ in. = 488.875 ft. ;
 $\sqrt{488.875^2 - 300^2} = 386.003 + \text{ft.},$ the perpendicular or the height of cathedral, *Ans.*



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2. $2^2 : 4^2 :: 6.2832 \text{ sq. ft.} : ()$;

$$\frac{6.2832 \times 4^2}{2^2} = 25.1328 + \text{sq. ft., Ans.}$$

4. $\sqrt{40} : \sqrt{25} :: 80 \text{ rd.} : ()$;

$$\frac{80 \times \sqrt{25}}{\sqrt{40}} = 63.245 + \text{rd., Ans.}$$

5. $\sqrt{314.16} : \sqrt{113.0976} :: 20 \text{ ft.} : ()$;

$$\frac{20 \times \sqrt{113.0976}}{\sqrt{314.16}} = 12 \text{ ft., Ans.}$$

6. $120 \text{ rd.} : () :: \sqrt{9} : \sqrt{6\frac{1}{4}}$;

$$\frac{120 \times \sqrt{6\frac{1}{4}}}{\sqrt{9}} = 100 \text{ rd., the length, Ans.}$$

$$12 : () :: \sqrt{9} : \sqrt{6\frac{1}{4}}$$

$$\frac{12 \times \sqrt{6\frac{1}{4}}}{9} = 10 \text{ rd., the breadth, Ans.}$$

7. $7.13 \text{ rd.} : () :: \sqrt{1} : \sqrt{5}$;

$$\sqrt{5} \times 7.13 = 15.94268 + \text{rd. Ans.}$$

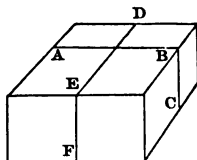
APPLICATIONS OF CUBE ROOT.**Page 333.**

1. $\sqrt[3]{91125}$ cu. ft. = 45 ft., the length of edge, *Ans.*
2. The cubical contents of a box 2 ft. 8 in. long, 2 ft. 3 in. wide, and 1 ft. 4 in. deep are 13824 cubic inches;
 $\sqrt[3]{13824}$ cu. in. = 24 in., the edge of cubical box, *Ans.*

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3. $\sqrt[3]{2197}$ cu. ft. = 13 ft., the depth of cistern, *Ans.*
4. Since there are 2150.4 cu. in. in a bushel, 1000 bu. will contain 2150400 cu. in.;
 $2150400 \text{ cu. in.} \div 1728 = 1244.444 + \text{cu. ft.};$
 $\sqrt[3]{1244.444}$ cu. ft. = 10.75 + ft., the depth of bin, *Ans.*
5. Since there are $31\frac{1}{2}$ gallons in a barrel and 231 cu. in. in a gallon, 300 barrels will contain $300 \times 31\frac{1}{2} \times 231$ cu. in., or 2182950 cu. in.;
 $2182950 \div 1728 = 1263.28125 + \text{cu. ft.};$
 $\sqrt[3]{1263.28125} = 10.81 + \text{ft.},$ the depth of cistern, *Ans.*
6. Since the bin is twice as long as it is wide or high, it is equal to two cubical bins each containing 1000 bu.;
 $2150.4 \text{ cu. in.} \times 1000 = 2150400 \text{ cu. in. in } 1000 \text{ bu.};$
 $2150400 \text{ cu. in.} \div 1728 = 1244.444 + \text{cu. ft.};$
 $\sqrt[3]{1244.444}$ cu. ft. = 10.75 + ft., the side of cubical bins and width and depth of bin;
 $10.75 \times 2 = 21.50 +$, the length of bin, *Ans.*

7. A bushel contains 2150.4 cu. in. Therefore,
 $\sqrt[3]{2150.4} = 12.89 + \text{in.}$, the depth of box, *Ans.*
8. $231 \text{ cu. in.} \times 31\frac{1}{2} = 7276.5 \text{ cu. in.}$, the cubical contents of a barrel;
 $\sqrt[3]{7276.5 \text{ cu. in.}} = 19.37 + \text{in.}$, the depth, *Ans.*
9. By referring to Ex. 5, the dimensions of such a cistern are $10.82 + \text{ft.}$;
 $10.82 \times 10.82 = 117.0724 \text{ sq. ft.}$, area of each side;
 $117.0724 \text{ sq. ft.} \times 5 = 585.362 \text{ sq. ft.}$, surface plastered;
 $585.362 \div 9 = 65.0402 + \text{sq. yd.}$;
 $\$.30 \times 65.04 = \$19.51 +$, *Ans.*
10. $2150.4 \text{ cu. in.} \times 100 = 215040 \text{ cu. in.}$, the cubical contents.
 Since the length is to be 3 times the width and height, the box will be equal to 3 equal cubes, each containing $\frac{1}{3}$ of 215040 cu. in., or 71680 cu. in. ;
 $71680 \text{ cu. in.} \div 1728 = 41.4814 + \text{cu. ft.}$;
 $\sqrt[3]{41.4814} + \text{cu. ft.} = 3.46 + \text{ft.}$, the width;
 $3.46 \text{ ft.} \times 3 = 10.38 + \text{ft.}$, the length, *Ans.*
11. $\sqrt[3]{13824 \text{ cu. ft.}} = 24 \text{ ft.}$, the length of side of cube;
 $24 \times 24 = 576 \text{ sq. ft.}$, the area of the side of the cube;
 $576 \text{ sq. ft.} \times 6 = 3456 \text{ sq. ft.}$, the entire surface of the cube.
 Since the height of the rectangular solid is *one-half* its length, and the width $\frac{3}{4}$ its length, if the solid be divided by the plane ABC cutting off $\frac{1}{3}$ of the width, and by DEF cutting into equal parts lengthwise, there will be



formed two equal cubes and two other parts, which together will be equal to another cube of the same size. Therefore the solid may be regarded as composed of three cubes, each of whose edges is equal to the height of the rectangular solid. Therefore, $\frac{1}{3}$ of 13824 cu. ft., or 4608 cu. ft., is the volume of each cube;

$\sqrt[3]{4608}$ cu. ft. = 16.64 + ft., the edge of cube and height of rectangular solid;

$16.64 + \text{ft.} \times 2 = 33.28 + \text{ft.}$, the length of the solid;

$\frac{2}{3}$ of $33.28 + \text{ft.} = 24.96 + \text{ft.}$, the width of the solid;

$16.64 \times 24.96 = 415.33 + \text{sq. ft.}$, the area of one end;

$415.33 + \text{sq. ft.} \times 2 = 830.66 + \text{sq. ft.}$, the area of both ends;

$33.28 \times 16.64 = 553.779 + \text{sq. ft.}$, the area of one side;

$553.779 \times 2 = 1107.558 + \text{sq. ft.}$, the area of two sides;

$33.28 \times 24.96 = 830.668 + \text{sq. ft.}$, the area of top;

$830.668 \text{ sq. ft.} \times 2 = 1661.336 + \text{sq. ft.}$, the area of top and bottom;

$830.66 + \text{sq. ft.} + 1107.558 + \text{sq. ft.} + 1661.336 + \text{sq. ft.} = 3599.55 + \text{sq. ft.}$, the entire surface of rectangular solid;

$3599.55 + \text{sq. ft.} - 3456 \text{ sq. ft.} = 143.55 + \text{sq. ft.}$, difference, *Ans.*

12. $\sqrt[3]{61026.048}$ cu. in. = 39.37 in., *Ans.*

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2. According to Prin. 2, expressed in a different way, the cube roots of the volumes of the solids are to each other as the dimensions of the solids. Therefore,

$$\sqrt[3]{800} \text{ lb.} : \sqrt[3]{6400} :: 5 \text{ ft.} : ();$$

$$\frac{5 \times \sqrt[3]{6400}}{\sqrt[3]{800}} = 10 \text{ ft., } \textit{Ans.}$$

$$3. 1^3 : 3^3 :: \$125 : ();$$

$$\$125 \times 27 = \$3375, \text{ the value, } \textit{Ans.}$$

$$4. \sqrt[3]{411.42} : \sqrt[3]{1000} :: 8 \text{ ft.} : ();$$

$$\frac{8 \times \sqrt[3]{1000}}{\sqrt[3]{411.42}} = 10.75 + \text{ft., } \textit{Ans.}$$

$$5. \sqrt[3]{1000} : \sqrt[3]{2000} :: () : 3 \text{ ft.};$$

$$\frac{3 \times \sqrt[3]{1000}}{\sqrt[3]{2000}} = 2.38 + \text{ft. diameter, } \textit{Ans.}$$

$$6. \sqrt[3]{1000} : \sqrt[3]{8000} :: 1\text{st bin} : 2\text{d bin}; \text{ or}$$

$$10 : 20 :: 1\text{st bin} : 2\text{d bin}; \text{ or,}$$

$$1 : 2 :: 1\text{st bin} : 2\text{d bin}; \text{ that is,}$$

The second bin is to be *twice* the first, *Ans.*

$$7. 1\text{st sphere} : 2\text{d sphere} :: 4^3 : 12^3; \text{ or,}$$

$$1\text{st sphere} : 2\text{d sphere} :: 64 : 1728; \text{ or,}$$

$$1\text{st sphere} : 2\text{d sphere} :: 1 : 27; \text{ that is,}$$

The second contains 27 times as much as the first, *Ans.*

8. Since each woman is to wind off $\frac{1}{3}$ of the yarn, the ball that is left after the first has wound off her share contains $\frac{2}{3}$ of the amount in the original ball; and since the corresponding dimensions of similar solids are to each other as the cube roots of their volumes (Prin. 2),

$$\sqrt[3]{1} : \sqrt[3]{\frac{2}{3}} :: 4 : (). \text{ Therefore,}$$

$4 \times \sqrt[3]{\frac{1}{3}} = 3.494$ in., the diameter of the ball when the second begins to wind off her share. Hence,

4 in. $- 3.494 = .506$, diameter wound off by first, *Ans.*

$\sqrt[3]{1} : \sqrt[3]{\frac{1}{3}} :: 4 : ()$. Therefore,

$4 \times \sqrt[3]{\frac{1}{3}} = 2.773$ in., the diameter of ball when the third begins to wind, *Ans.*

3.494 in. $- 2.773$ in. $= .721$ in., the diameter wound off by second, *Ans.*

9. $\sqrt[3]{8} : \sqrt[3]{60} :: 12$ ft. $: ()$;

$6 \times \sqrt[3]{60} = 23.48$ ft., height, *Ans.*

PROGRESSIONS.

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2. $10 + (5 \times 9) = 55$, the 10th term, *Ans.*

3. $6 + (8 \times 24) = 198$, the 25th term, *Ans.*

4. His daily wages would form an arithmetical series of which the first term is \$.25, the common difference \$.03, and the number of terms 50. Therefore, $$.25 + ($.03 \times 49) = \$1.72$, the 50th or last day's wages, *Ans.*

5. The first term is therefore $16\frac{1}{2}$ ft., the common difference 2 times $16\frac{1}{2}$ ft., or $32\frac{1}{2}$ ft., and the number of terms 7. Therefore, $16\frac{1}{2}$ ft. $+ (32\frac{1}{2}$ ft. $\times 6) = 209\frac{1}{2}$ ft., the distance it falls the seventh second, *Ans.*

6. $75 + (5 \times 999) = 5070$, the 1000th term, *Ans.*

8. $2 + (3 \times 49) = 149$, the last term ;

$$\frac{2 + 149}{2} \times 50 = 3775, \text{ the sum, } \textit{Ans.}$$

9. $\frac{1}{10} + (\frac{1}{10} \times 99) = 10$, the last term ;

$$\frac{\frac{1}{10} + 10}{2} \times 100 = 505, \text{ the sum, } \textit{Ans.}$$

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10. $15 + (3 \times 10) = 45$, the distance traveled the 11th day ;

$$\frac{15 + 45}{2} \times 11 = 330, \text{ the whole distance, } \textit{Ans.}$$

11. Since it strikes *one* first and *twelve* last,

$$\frac{1 + 12}{2} \times 12 = 78, \text{ the whole number of strokes, } \textit{Ans.}$$

12. Since the annual increase was \$6 per year, the first term \$100, and the number of years 21, an arithmetical series is formed :

$$\$100 + (\$6 \times 20) = \$220, \text{ the last term ;}$$

$$\frac{100 + 220}{2} \times 21 = \$3360, \text{ the amount due, } \textit{Ans.}$$

2. $10 \times 3^5 = 2430$, the 6th term, *Ans.*

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3. $10 \times 4^5 = 10240$, the 6th term, *Ans.*

4. His wages would form a geometrical progression in which the first term is 5, the ratio 3, and the number of terms 10. Therefore,

$$$.05 \times 3^9 = \$984.15, \text{ his wages for the last day, } \textit{Ans.}$$

5. $\$100 \times 1.06^5 = \133.82 , the sixth term, *Ans.*

6. Since the amount for the first year is 1.05 of \$520, the first term will be \$546. Therefore,

$$\$546 \times 1.05^5 = \$696.849 +, \text{ the amount, } \textit{Ans.}$$

8. $\frac{(1024 \times 4) - 4}{4 - 1} = 1364$, the sum, *Ans.*

9. $\frac{(\frac{11}{8} \times 2\frac{1}{2}) - \frac{1}{8}}{2\frac{1}{2} - 1} = 4\frac{11}{16}$, the sum, *Ans.*

10. $\frac{(2 \times \frac{1}{2}) - 0}{1 - \frac{1}{2}} = 4$, the sum, *Ans.* $\frac{2 - (0 \times \frac{1}{2})}{1 - \frac{1}{2}} = \frac{2}{\frac{1}{2}}$

MENSURATION.

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1. $10 \times 3.1416 = 31.416$, the circumference, *Ans.*
2. $45 \times 3.1416 = 141.3720$, the circumference, *Ans.*
3. $300 \times 3.1416 = 942.48$ rd. in circumference;
 $942.48 \div 320 = 2$ mi. 302.48 rd., *Ans.*

4. Since the radius is 20 rd., the diameter is 40 rd.;
 $40 \times 3.1416 = 125.6640$ rd., *Ans.*

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5. 5 ft. 6 in. $\times 2 = 11$ ft., the diameter;
 $11 \times 3.1416 = 34.5576$, the circumference, *Ans.*
6. $318.5 \div 3.1416 = 101.38 +$ rd., *Ans.*
7. $1284 \div 3.1416 = 408.708 +$, the diameter;
 $408.708 \div 2 = 204.354 +$ rd., the radius, *Ans.*

-
- . $13 \times 40 = 520$ sq. ft., *Ans.*
2. 3 ft. 8 in. $= 3\frac{2}{3}$ ft.; $7 \times 3\frac{2}{3} = 25\frac{2}{3}$ sq. ft., *Ans.*
3. $24 \times 30 = 720$ sq. rd.; the area, *Ans.*
4. $35 \times 15 = 525$ sq. ft., the area, *Ans.*

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1. $\frac{24 \times 18}{2} = 216$ sq. ft., *Ans.*
2. $\frac{21 \times 12}{2} = 126$ sq. ft., *Ans.*
3. Since the shortest side is 120 ft., and the sides are in a ratio of 5, 6 and 8, 120 ft. must be $\frac{5}{8}$ of the length of the next side; 120 ft. are $\frac{5}{8}$ of 144 ft., the second side; for similar reasons 144 ft. must be $\frac{6}{8}$ of length of next side; 144 ft. are $\frac{6}{8}$ of 192 ft., the length of third side;

$$120 + 144 + 192 = 228; 228 - 120 = 108;$$

$$228 - 144 = 84; 228 - 192 = 36;$$

$$\sqrt{228 \times 108 \times 84 \times 36} = 8629.19 \text{ sq. ft., the area;}$$

$$8629.19 \text{ sq. ft.} \div 43560 = .19809 \text{ acres;}$$

$$\$850 \times .19809 = \$168.376 +, \text{ the cost, } \textit{Ans.}$$

$$4. \frac{180 + 150 + 80}{2} = 205; 205 - 180 = 25;$$

$$205 - 150 = 55; 205 - 80 = 125;$$

$$\sqrt{205 \times 25 \times 55 \times 125} = 5935.85 \text{ sq. ft., area, } \textit{Ans.}$$

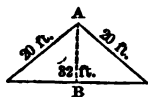
5. The perpendicular line A B divides the base into two equal parts. Therefore, one-half the base is 16 ft. Therefore,

$$\sqrt{20^2 - 16^2} = 12, \text{ the altitude A B;}$$

$$\frac{12 \times 16}{2} = 96 \text{ sq. ft., area of one end;}$$

$$96 \text{ sq. ft.} \times 2 = 192 \text{ sq. ft., area of both ends, and amount of lumber needed;}$$

$$192 \text{ sq. ft., @ } \$22\frac{1}{2} \text{ per M, cost } \$8.64, \textit{ Ans.}$$



$$6. \frac{100 \times 100}{2} = 5000 \text{ sq. ft., the area, } \textit{Ans.}$$

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$$1. 110 \times \frac{40 + 60}{2} = 5500 \text{ sq. ft., the area, } \textit{Ans.}$$

$$2. (10 + 8) \times \frac{3}{2} = 54 \text{ sq. rd., the area, } \textit{Ans.}$$

$$3. 96 \times \frac{1}{2} = 576 \text{ sq. ft., the area, } \textit{Ans.}$$

$$4. (40 + 30) \times \frac{20}{2} = 700 \text{ sq. rd.; } 700 \text{ sq. rd.} \div 160 = 4\frac{3}{8} \text{ A.;}$$

$$\$125 \times 4\frac{3}{8} = \$546.875, \text{ the cost, } \textit{Ans.}$$

$$5. 120 \times \frac{10 + 20}{2} = 3000 \text{ sq. rd.; } 3000 \text{ sq. rd.} \div 160 = 18\frac{3}{4} \text{ A.;}$$

$$\$110 \times 18\frac{3}{4} = \$2062.50, \text{ the cost, } \textit{Ans.}$$

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1. $5^2 \times .7854 = 19.635$ sq. ft., the area, *Ans.*
2. $8^2 \times .7854 = 50.265+$ sq. ft., the area, *Ans.*
3. $120 \div 3.1416 = 38.197+$ rd., the diameter;
 $\frac{1}{2}$ of $(120 \times \frac{38.197}{2}) = 1145.7$ sq. rd., the area, *Ans.*
4. $100 \div 3.1416 = 31.8309+$ ft., the diameter;
 $\frac{1}{2}$ of $(100 \times \frac{31.8309}{2}) = 795.77$ sq. ft., the area, *Ans.*
5. $320 \div 3.1416 = 101.8589+$ rd., the diameter,
 $\frac{1}{2}$ of $(320 \times \frac{101.8589}{2}) = 8148.712+$ sq. rd., the area;
 8148.712 sq. rd. $\div 160 = 50.929+$ A., *Ans.*
6. 15 rd. $\times 2 = 30$ rd., the diameter;
 $30^2 \times .7854 = 706.86$ sq. rd., the area, *Ans.*
7. Since the area is the square of the diameter multiplied by .7854, if the area is divided by .7854 the quotient will be the square of the diameter. The square root of this quotient will be the diameter, and half of the diameter will be the radius or the length of the rope.
 160 sq. rd. $\div .7854 = 203.7178+$ sq. rd., the square of the diameter;
 $\sqrt{203.7178}$ sq. rd. $= 14.27+$ rd., the diameter;
 $14.27+$ rd. $\div 2 = 7.13+$ rd., the radius, the length of the rope, *Ans.*
8. 113.0976 sq. rd. $\div .7854 = 144$ sq. rd., the square of the diameter;
 $\sqrt{144}$ sq. rd. $= 12$ rd., the diameter, *Ans.*

9. $350^2 \times .7854 = 96211.5$ sq. ft. ;
 96211.5 sq. ft. $\div 272\frac{1}{2} = 353.3939 +$ sq. rd. ;
 $353.3939 +$ sq. rd. $\div 160 = 2$ A. $33.3939 +$ sq. rd., the
 area, *Ans.*
10. $35^2 \times .7854 = 962.115$ sq. ft., the area, *Ans.*

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1. 2 ft. $\times 3.1416 = 6.2832$ ft., the perimeter ;
 $6.2832 \times 5 = 31.416$ sq. ft., the convex surface, *Ans.*
2. $2\frac{1}{2}$ ft. $\times 4 = 10$ ft., the perimeter of prism ;
 $10 \times 4 = 40$ sq. ft., the convex surface, *Ans.*
3. 6 ft. $\times 3 = 18$ ft., the perimeter of prism ;
 $18 \times 8 = 144$ sq. ft., the convex surface, *Ans.*
4. 2 ft. $\times 3.1416 = 6.2832$ ft., the perimeter ;
 $6.2832 \times 5 = 31.416$ sq. ft., convex surface ;
 $(2^2 \times .7854) \times 2 = \underline{6.2832}$ sq. ft., area of ends ;
 37.6992 , the entire surface, *Ans.*
5. 10 in. $+ 14$ in. $+ 18$ in. $= 42$ in., or $3\frac{1}{2}$ ft., perimeter ;
 $3\frac{1}{2} \times 18 = 63$ sq. ft., the convex surface, *Ans.*

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1. 15 ft. $\times 4 = 60$ ft., the perimeter of base ;
 $60 \times 1\frac{1}{2} = 540$ sq. ft., the convex surface, *Ans.*
2. 12 ft. $\times 3.1416 = 37.6992$ ft., the perimeter of base ;
 $37.6992 \times 2\frac{1}{2} = 376.992$, sq. ft., convex surface, *Ans.*

3. $20 \text{ ft.} \times 3.1416 = 62.832 \text{ ft.}$, the perimeter of base;
 $62.832 \times \frac{2}{2} = 628.32 \text{ sq. ft.}$, the convex surface, *Ans.*
4. $6 \text{ ft.} \times 8 = 48 \text{ ft.}$, the perimeter of base;
 $48 \times \frac{2}{2} = 1920 \text{ sq. ft.}$, the convex surface;
 $1920 \div 9 = 213\frac{1}{3} \text{ sq. yd.}$; $\$.30 \times 213\frac{1}{3} = \64 , *Ans.*
5. $6 \text{ ft.} \times 3.1416 = 18.8496 \text{ ft.}$, the perimeter of base;
 $18.8496 \times \frac{2}{2} = 89.5356 \text{ sq. ft.}$, convex surface, *Ans.*
6. $10 \text{ ft.} \times 4 = 40 \text{ ft.}$, the perimeter of base
 $40 \times \frac{2}{2} = 400 \text{ sq. ft.}$, the convex surface, *Ans.*
7. $8 \text{ ft.} \times 3.1416 = 25.1328 \text{ ft.}$, the perimeter;
 $25.1328 \times \frac{2}{2} = 75.3984 \text{ sq. ft.}$, convex surface, *Ans.*
8. $10 \text{ ft.} \times 3.1416 = 31.416 \text{ ft.}$, the perimeter of base;
 $31.416 \times \frac{2}{2} = 157.08 \text{ sq. ft.}$, the convex surface, *Ans.*

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1. $12 \text{ ft.} \times 3.1416 = 37.6992 \text{ ft.}$, perimeter of lower base;
 $8 \text{ ft.} \times 3.1416 = 25.1328 \text{ ft.}$, perimeter of upper base;
 $\frac{1}{2} \times (37.6992 + 25.1328) \times 8 = 251.328 \text{ sq. ft.}$, convex surface, *Ans.*
2. $40 \text{ ft.} \times 4 = 160 \text{ ft.}$, perimeter of lower base;
 $20 \text{ ft.} \times 4 = 80 \text{ ft.}$, perimeter of upper base;
 $\frac{1}{2} \times (160 + 80) \times 25 = 3000 \text{ sq. ft.}$, convex surface.
3. $10 \text{ ft.} \times 3.1416 = 31.416 \text{ ft.}$, perimeter of lower base;
 $8 \text{ ft.} \times 3.1416 = 25.1328 \text{ ft.}$, perimeter of upper base;
 $\frac{1}{2} \times (31.416 + 25.1328) \times 12 = 339.2928 \text{ sq. ft.}$, convex surface;

$$339.2928 \text{ sq. ft.} \div 9 = 37.6992 \text{ sq. yd.};$$

$$\$.15 \times 37.6992 = \$5.654 +, \text{ the cost, } \textit{Ans.}$$

4. $9 \text{ ft.} \times 4 = 36 \text{ ft.}$, perimeter of lower base;
 $8 \text{ ft.} \times 4 = 32 \text{ ft.}$, perimeter of upper base;
 $\frac{1}{2} \times (36 + 32) \times 10 = 340 \text{ sq. ft.}$, convex surface.

5. The area of sides is 340 sq. ft. Since the plank for the sides is $1\frac{1}{2}$ in. thick, the lumber required will be $1\frac{1}{2}$ times 340, which is 510 ft., board measure.

- $9 \times 9 = 81 \text{ sq. ft.}$, the area of the base. Since the plank is 2 in. thick, the lumber required for the bottom will be 2 times 81, which is 162 ft., board measure.

$$510 + 162 = 672 \text{ ft. lumber};$$

$$672 \text{ ft. @ } \$40 \text{ per M} = \$26.88, \textit{Ans.}$$

1. $15^2 \times 3.1416 = 706.86 \text{ sq. in.}$, the surface;
 $706.86 \text{ sq. in.} \div 144 = 4.908 + \text{ sq. ft.}$, *Ans.*
2. $8^2 \times 3.1416 = 201.0624 \text{ sq. in.}$, the surface;
 $201.0624 \text{ sq. in.} \div 144 = 1.396 + \text{ sq. ft.}$, *Ans.*
3. $9\frac{1}{2} \text{ in.} \div 3.1416 = 2.9045 + \text{ in.}$, the diameter;
 $9\frac{1}{2} \times 2.9045 + = 26.50 + \text{ sq. in.}$, the surface, *Ans.*

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4. $12 \div 3.1416 = 3.8197 + \text{ ft.}$, the diameter;
 $12 \times 3.8197 = 45.836 + \text{ sq. ft.}$, the surface, *Ans.*
-

1. $1 \times 1 = 1 \text{ sq. ft.}$, the area of base;
 $1 \times 2 = 2 \text{ cu. ft.}$, the solid contents, *Ans.*

2. $(1\frac{1}{2})^2 \times .7854 = 1.76715$ sq. ft., the area of base;
 $1.76715 \times 4 = 7.0686$ cu. ft., the solid contents, *Ans.*
3. $20 \times 1\frac{1}{2} \times 1 = 30$ cu. ft., the solid contents of stick;
 $\$.30 \times 30 = \9.00 , the cost, *Ans.*
4. $8 \times 8 = 64$ sq. ft., the area of base;
 $64 \times 9 = 576$ cu. ft., the volume of the bin;
 1728 cu. in. $\times 576 = 995328$ cu. in.;
 995328 cu. in. $\div 2150.4 = 462.85 +$ bu., *Ans.*
5. $8^2 \times .7854 = 50.2656$ sq. ft., the area of base;
 $50.2656 \times 7 = 351.8592$ cu. ft., the volume of the vat;
 1728 cu. in. $\times 351.8592 = 608012.6976$ cu. in.;
 608012.6976 cu. in. $\div 231 = 2632.089 +$ gal., *Ans.*
6. $15 \times 15 = 225$ sq. ft., the area of base;
 $225 \times 12 = 2700$ cu. ft., the volume of the bin;
 1728 cu. in. $\times 2700 = 4665600$ cu. in.;
 $4665600 \div 2150.4 = 2169.642 +$, number of bushels;
 $\$1.85 \times 2169.642 = \$4013.837 +$, value of wheat, *Ans.*

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1. $6^2 \times .7854 = 28.2744$ sq. ft., the area of base;
 $28.2744 \times \frac{2}{3} = 84.8232$ cu. ft., the solid contents, *Ans.*
2. $30 \times 30 = 900$ sq. ft., the area of base;
 $900 \times \frac{4}{3} = 18000$ cu. ft., the solid contents, *Ans.*
3. $6^2 \times .7854 = 28.2744$ sq. ft., the area of base;
 $28.2744 \times \frac{2}{3} = 75.3984$ cu. ft., the solid contents;
 165 lb. $\times 75.3984 = 12440.736$ lb., *Ans.*

4. $4 \times 4 = 16$ sq. ft., the area of base;
 $16 \times \frac{8}{3} = 42\frac{2}{3}$ cu. ft., the solid contents;
 $171 \text{ lb.} \times 42\frac{2}{3} = 7296 \text{ lb.}$, *Ans.*
-

1. $20 \times 20 = 400$ sq. ft., the area of lower base;
 $10 \times 10 = 100$ sq. ft., the area of upper base;
 $\sqrt{400 \times 100} = 200$ sq. ft., the mean proportional;
 $(400 + 100 + 200) \times \frac{20}{3} = 4666\frac{2}{3}$ cu. ft., the volume.

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2. $5^2 \times .7854 = 19.635$ sq. ft., the area of upper base;
 $8^2 \times .7854 = 50.2656$ sq. ft., the area of lower base;
 $\sqrt{19.635 \times 50.2656} = 31.416$, the mean proportional;
 $(19.635 + 50.2656 + 31.416) \times \frac{7}{3} = 236.405 +$ cu. ft.,
the volume, *Ans.*
3. $3^2 \times .7854 = 7.0686$ sq. ft., the area of lower base;
 $1^2 \times .7854 = .7854$ sq. ft., the area of upper base;
 $\sqrt{7.0686 \times .7854} = 2.3562 +$ sq. ft., the mean proportional;
 $(7.0686 + .7854 + 2.3562) \times \frac{40}{3} = 136.136 +$ cu. ft.,
the volume, *Ans.*
4. $12^2 \times .7854 = 113.0976$ sq. ft., the area of lower base;
 $10^2 \times .7854 = 78.54$ sq. ft., the area of upper base;
 $\sqrt{113.0976 \times 78.54} = 94.248 +$ sq. ft., the mean proportional;
 $(113.0976 + 78.54 + 94.248) \times \frac{8}{3} = 857.6568$ cu. ft.,
the volume;

$$1728 \text{ cu. in.} \times 857.6568 \div 231 = 6415.718 + \text{gal., } \textit{Ans.}$$

1. $5^3 \times .5236 = 65.45 \text{ cu. ft., the volume, } \textit{Ans.}$

2. $8^3 \times .5236 = 268.0832 \text{ cu. ft., the volume, } \textit{Ans.}$

3. $9.4248 \div 3.1416 = 3$, the diameter;

$$3^3 \times .5236 = 14.1372 \text{ cu. ft., the volume, } \textit{Ans.}$$

4. $18 \text{ in.} = 1\frac{1}{2} \text{ ft.; } (1\frac{1}{2})^3 \times .5236 = 1.76715 \text{ cu. ft.;}$

$$450 \text{ lb.} \times 1.76715 = 795.217 + \text{lb., weight of ball, } \textit{Ans.}$$

5. $(2\frac{1}{2})^3 \times .5236 = 8.181 \text{ cu. ft., the volume, } \textit{Ans.}$

6. $(25)^3 \times .5236 = 8181.25 \text{ cu. ft., the volume, } \textit{Ans.}$

MISCELLANEOUS EXAMPLES.

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1. It will take 6 men $\frac{5}{8}$ of 12 days, or 10 days, *Ans.*

2. They will cost $\frac{2}{3}$ of \$7.50, or \$12, *Ans.*

3. Since 20 men are required to load the vessel in 6 days, it would require 120 men to load it in 1 day. Therefore as many men would be needed to load it in $1\frac{1}{2}$ days as $1\frac{1}{2}$ is contained times in 120, which is 80 men, *Ans.*

4. Since she sailed $42\frac{1}{2}$ miles in $2\frac{1}{2}$ hours, $42\frac{1}{2} \div 2\frac{1}{2} = 17$ miles, the rate per hour. Therefore, in 20 minutes, or $\frac{1}{3}$ of an hour, she sailed $\frac{1}{3}$ of 17 miles, which is $5\frac{2}{3}$ miles, *Ans.*

5. $28 \text{ rd.} : 56 \text{ rd.} \left. \begin{array}{l} \\ \frac{3}{4} \text{ da.} : 1 \text{ da.} \end{array} \right\} :: 6 \text{ men} : () ;$

$$\frac{56 \times 1 \times 6 \text{ men}}{28 \times \frac{3}{4}} = 16 \text{ men, } \textit{Ans.}$$

6. $\frac{3}{4} \text{ yd.} : \frac{7}{8} \text{ yd.} :: \$3\frac{3}{8} : () ;$

$$\frac{\$3\frac{3}{8} \times \frac{7}{8}}{\frac{3}{4}} = \$5\frac{1}{4}, \textit{Ans.}$$

7. The board of 8 persons for $2\frac{1}{2}$ weeks is the same as the board of 1 person for 8 times $2\frac{1}{2}$ weeks, or 20 weeks; and the board of 10 persons for 3 weeks is the same as the board of 1 person for 30 weeks. Therefore, since the board of 1 person for 20 weeks is \$50, for 1 week it will be $\frac{1}{20}$ of \$50, or $\$2\frac{1}{2}$; and the board of 1 person for 30 weeks will be 30 times $\$2\frac{1}{2}$, or \$75, *Ans.*

8. Since 3 lb. tea are worth 14 lb. coffee,
 1 lb. tea is worth $4\frac{2}{3}$ lb. coffee, and
 7 lb. tea are worth $32\frac{2}{3}$ lb. coffee.

Since 5 lb. coffee are worth 18 lb. sugar,
 1 lb. coffee is worth $3\frac{4}{5}$ lb. sugar, and
 $32\frac{2}{3}$ lb. coffee are worth $117\frac{2}{3}$ lb. sugar.

Since 21 lb. sugar are worth 60 lb. flour,
 1 lb. sugar is worth $2\frac{6}{7}$ lb. flour, and
 $117\frac{2}{3}$ lb. sugar are worth 336 lb. flour. Therefore,
 7 lb. tea are worth 336 lb. flour, *Ans.*

9. \$.23 \times 56 \times 12 = \$154.56, value of butter;

\$.85 \times 5 = \$4.25, cost of tea;

\$.13 \times 60 = 7.80, cost of sugar;

\$1.12 $\frac{1}{2}$ \times 15 = 16.875, cost of cloth;

\$28.925, cost of purchase. Therefore,

\$154.56 - \$28.925 = \$125.635, money received, *Ans.*

10. Since $\frac{1}{3}$ of the provision was useless, they received $\frac{2}{3}$ of the daily allowance, which was $\frac{2}{3}$ of 15 ounces, or 10 ounces, *Ans.*

11. Since it required 5 more than 3 times the number of sheep to make 185, if 5 be subtracted from 185 the remainder will be 3 times the number of sheep. Therefore, 3 times the number of sheep = 180, and the number of sheep = 60, *Ans.*

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12. Since $\frac{1}{2}$ of last remainder = \$5, last remainder = \$10.
 Since $\frac{1}{2}$ of previous rem'r = \$10, previous rem'r = \$20.
 Since $\frac{1}{2}$ of previous rem'r = \$20, previous rem'r = \$40.
 Since $\frac{1}{2}$ of his money = \$40, his money = \$80.

13. A can do $\frac{1}{15}$ of the work in 1 day,
 B can do $\frac{1}{18}$ of the work in 1 day,
 C can do $\frac{1}{20}$ of the work in 1 day;
 All working together can do $\frac{1}{15} + \frac{1}{18} + \frac{1}{20}$, or $\frac{31}{180}$ of the work in 1 day.
 It will therefore require as many days for all to do the work as $\frac{31}{180}$ is contained times in $\frac{180}{31}$, or $5\frac{25}{31}$ days.

14. $4\frac{1}{2}$ bu. $\times 100 = 466\frac{2}{3}$ bu., the wheat needed for 100 barrels of flour.

Since the miller took $\frac{1}{3}$ for grinding, the amount used for flour was only $\frac{2}{3}$ of the quantity taken to mill.

Therefore, $466\frac{2}{3}$ bu. $\div \frac{2}{3} = 533\frac{1}{3}$ bu., the quantity taken to mill.

$\$.02\frac{1}{4} \times 533\frac{1}{3} = \12 , expense of taking it to mill;

$\$.45 \times 100 = \45 , cost of barrels;

$\$.25 \times 100 = \25 , commission;

\$82, expenses.

$\$550 + \$165 + \$100 = \815 , the receipts;

$\$815 - \$82 = \$733$, the net receipts;

$\$1.45 \times 533\frac{1}{3} = \773.33 , amount offered;

$\$773.33 - \$733 = \$40.33$, loss, *Ans.*

15. Since 3 times the number of trees $+ 5 = 1358$ trees,
3 times the number of trees $= 1353$ trees, and the
number of trees $= 451$ trees, *Ans.*

16. Since $\frac{1}{2}$ of A's money $= \frac{3}{4}$ of B's,

The whole of A's money $= \frac{3}{2}$ of B's.

Therefore A's money exceeded B's by $\frac{1}{2}$.

Therefore $\frac{1}{2}$ of B's money $= \$8$;

The whole of B's money $= \$40$, *Ans.*

A's money $= \frac{3}{2}$ of B's $= \$48$, *Ans.*

17. Since 2 cattle eat as much as 7 sheep, B's 24 cattle eat
as much as 84 sheep, and C's 10 cattle and 35 sheep
eat as much as 70 sheep. Therefore,

70 sheep for $6\frac{1}{2}$ mo. = 455 sheep for 1 mo., A's;
 84 sheep for $4\frac{1}{2}$ mo. = 350 sheep for 1 mo., B's;
 70 sheep for $5\frac{1}{2}$ mo. = 385 sheep for 1 mo., C's;
 Whole No. for the time = 1190 for 1 mo. Therefore,
 $\frac{455}{1190}$ of \$170, or \$65 = A's share;
 $\frac{350}{1190}$ of \$170, or \$50 = B's share;
 $\frac{385}{1190}$ of \$170, or \$55 = C's share, *Ans.*

18. Since a pole 10 feet long casts a shadow 13 feet long, a pole $\frac{10}{13}$ of a foot in length would cast a shadow 1 foot long; and therefore to cast a shadow $62\frac{1}{2}$ feet long, the pole would have to be $62\frac{1}{2}$ times $\frac{10}{13}$ ft., or $48\frac{1}{8}$ ft., *Ans.*
19. Since C's weight is equal to the sum of A's and B's, it must be $\frac{1}{2}$ of the sum of their weights. $\frac{1}{2}$ of 490 lb. = 245 lb., C's weight.

Since A's weight is only $\frac{3}{4}$ of B's, the weight of both would be $1\frac{3}{4}$ times B's weight. Therefore,

$1\frac{3}{4}$, or $\frac{7}{4}$, of B's weight = 245 lb.;

$\frac{1}{4}$ of B's weight = 35 lb.;

B's weight = 140 lb.;

A's weight = $\frac{3}{4}$ of B's = $\frac{3}{4}$ of 140 = 105 lb., *Ans.*

20. Since $\frac{3}{8}$ of A's money = $\frac{4}{7}$ of B's,
 $\frac{1}{8}$ of A's money = $\frac{1}{8}$ of $\frac{4}{3}$, or $\frac{4}{27}$, of B's, and
 The whole of A's money = 8 times $\frac{4}{27}$, or $\frac{32}{27}$, of B's.
 Therefore, since A's money is $\frac{32}{27}$ of B's, his money exceeds B's by $\frac{5}{27}$; and
 $\frac{5}{27}$ of B's money = \$5;
 $\frac{1}{27}$ of B's money = \$1;
 The whole of B's money = \$27;
 A's money = \$5 + \$27 = \$32, *Ans.*

21. Since their ages are in the ratio of 3, 4 and 5,
 3 times a certain number = A's age;
 4 times a certain number = B's age;
 5 times a certain number = C's age. Therefore,
 12 times a certain number = the sum of their ages,
 136 yr., and
 The number = $\frac{1}{12}$ of 136 yr., or $11\frac{1}{3}$ yr. Hence,
 3 times $11\frac{1}{3}$ yr., or 34 yr. = A's age;
 4 times $11\frac{1}{3}$ yr., or $45\frac{1}{3}$ yr. = B's age;
 5 times $11\frac{1}{3}$ yr., or $56\frac{2}{3}$ yr. = C's age, *Ans.*

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22. He paid $1\frac{1}{4}$ cents each, and sold them for $1\frac{1}{8}$ cents each. He gained $\frac{1}{12}$ of a cent on each apple, and must sell 12 apples to gain 1 cent. Therefore, to gain 60 cents, he must have sold 60 times 12, or 720 apples.
23. A and B can do $\frac{1}{8}$ of the work in 1 day;
 B and C can do $\frac{1}{8}$ of the work in 1 day;
 A and C can do $\frac{1}{6}$ of the work in 1 day;
 $\frac{1}{8} + \frac{1}{8} + \frac{1}{6} = \frac{807}{2912}$, twice the part that all can do in 1 day;
 $\frac{1}{2}$ of $\frac{807}{2912} = \frac{807}{5824}$, part that all can do in 1 day;
 $\frac{5824}{5824} \div \frac{807}{5824} = 18\frac{298}{807}$ days, time in which all can do it;
 $\frac{807}{5824} - \frac{1}{8} = \frac{99}{5824}$, part A can do in 1 day;
 $\frac{5824}{5824} \div \frac{99}{5824} = 58\frac{82}{99}$ days, time in which A can do it;
 $\frac{807}{5824} - \frac{1}{6} = \frac{83}{5824}$, part B can do in 1 day;
 $\frac{5824}{5824} \div \frac{83}{5824} = 70\frac{14}{83}$ days, time in which B can do it;
 $\frac{807}{5824} - \frac{1}{3} = \frac{125}{5824}$, part C can do in 1 day;
 $\frac{5824}{5824} \div \frac{125}{5824} = 46\frac{74}{125}$ days, time in which C can do it.

24. A can do $\frac{1}{120}$ of the work in 1 hour;
 B can do $\frac{1}{90}$ of the work in 1 hour;
 $\frac{1}{120} + \frac{1}{90} = \frac{7}{360}$, part both can do in 1 hour;
 $\frac{360}{7} \div \frac{7}{360} = 51\frac{3}{7}$, number of hours it takes both to do it;
 $51\frac{3}{7} \div 8 = 6\frac{3}{7}$, number of days of 8 hours each, *Ans.*
25. Since one is worth $\frac{5}{8}$ as much as the other, the value of both would be $1\frac{5}{8}$ times the value of the better horse.
 Therefore, $1\frac{5}{8}$, or $1\frac{3}{4}$, of value better horse = \$390
 $\frac{1}{4}$ of value of better horse = \$30
 The value of better horse = \$240, *Ans.*
 The value of poorer horse = $\frac{3}{4}$ of \$240 = \$150, *Ans.*
26. $4\frac{1}{2} \times 3.1416 \times 720 = 10178.784$ ft., distance traveled;
 $4 \times 3.1416 = 12.5664$ ft., circumference of fore-wheel;
 $10178.78 \div 12.5664 = 810$, revolutions, *Ans.*
27. Since a shadow 9 inches long was produced by a 6-foot pole, a shadow 1 inch long would be produced by a pole $\frac{2}{3}$, or $\frac{2}{3}$, of a foot in length. Therefore a shadow 9 feet, or 108 inches, must have been produced by a pole 108 times $\frac{2}{3}$ foot, which is 72 feet, *Ans.*
28. $\$245.30 \times .0155 = \3.80 , *Ans.*
29. He steps 60 inches in 3 seconds, or 20 inches per second. It will require as long for him to walk 10 miles as 20 inches are contained in 633600, the number of inches in 10 miles, which is 31680 seconds, which are equal to 8 hours 48 minutes, *Ans.*
30. 4 grown persons and 3 children = 6 grown persons;
 3 grown persons and 8 children = $8\frac{1}{2}$ grown persons.

Therefore, $6 : 8\frac{1}{2} :: \$150 : ()$;

$$\frac{\$150 \times 8\frac{1}{2}}{6} = \$208.33\frac{1}{3}, \text{ Ans.}$$

31. (1) 20 bu. wheat + 15 bu. corn cost \$36;
 (2) 15 bu. wheat + 25 bu. corn cost \$32.50.

Therefore, taking 3 times the quantities in (1) and 4 times the quantities in (2), we have (3) and (4).

- (3) 60 bu. wheat + 45 bu. corn would cost \$108, and
 (4) 60 bu. wheat + 100 bu. corn would cost \$130.

Therefore, since the quantity of wheat is the same in (3) and (4), the difference in value must be caused by the difference in quantity of corn. Therefore,

55 bu. corn cost \$22; 1 bu. corn cost $\frac{22}{55}$, or $\frac{2}{5}$ of a dollar, or \$.40, *Ans.*

Since 20 bu. wheat + 15 bu. corn cost \$36, and 15 bu. corn cost \$6, 20 bu. wheat must cost \$30; 1 bu. wheat must cost \$1.50, *Ans.*

32. He gains 4 rods of every 30 he runs; therefore, in order to gain 120 rods, he must run 30 rods 30 times, or 900 rods, *Ans.*

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33. A is 18 miles in advance of B. Since B gains 1 mile of every 4 miles he travels, to gain 18 miles he must travel 4 miles 18 times, or 72 miles, *Ans.*

34. Therefore the difference between $\frac{1}{4}$ and $\frac{1}{5}$ of the number was equal to 10. $\frac{1}{4} - \frac{1}{5} = \frac{1}{20}$. Therefore $\frac{1}{20}$ of the number was 10; the number was 20 times 10, or 200.

35. A number $+ \frac{1}{2}$ of it and $\frac{1}{3}$ of it make $1\frac{5}{6}$, or $1\frac{11}{6}$, times the number. Since $\frac{1}{6}$ of the number $= 105$, $\frac{1}{3}$ of the number $= 9\frac{5}{11}$; the number $= 6$ times $9\frac{5}{11}$, or $57\frac{3}{11}$.

36. A number $+ \frac{2}{3}$ of it $= \frac{5}{3}$ of the number. Therefore, $\frac{5}{3}$ of the number $+ 15 = 40$. Since 15 has to be added to $\frac{5}{3}$ of the number to make 40, $\frac{5}{3}$ of the number must be 15 less than 40, or 25. Therefore, $\frac{5}{3}$ of the number $= 25$; $\frac{1}{3}$ of the number $= 5$; the number $= 15$, *Ans.*

37. Since 20 men need 45 days to do the work, 1 man would require 20 times 45 days, or 900 days; and 30 men would require $\frac{1}{3}$ of 900 days, or 30 days, *Ans.*

38. $\frac{1}{4}$ da. : $\frac{3}{8}$ da. :: $\$ \frac{5}{8}$: (); $\$ \frac{5}{8} \times \frac{8}{3} \div \frac{3}{4} = \$ \frac{20}{3}$, *Ans.*

39. $4\frac{1}{4} \times 1\frac{3}{8} = \frac{17}{4} \times \frac{11}{8} = 1\frac{187}{32}$ sq. yd., the square contents of broadcloth;

$1\frac{187}{32} \div \frac{3}{8} = 15\frac{7}{12}$ yd., the amount of silk, *Ans.*

40. $\left. \begin{array}{l} 2\frac{1}{4} : 6\frac{1}{4} \\ 1 : 1\frac{1}{4} \end{array} \right\} :: 14 : (); \frac{14}{1} \times \frac{13}{2} \times \frac{5}{4} \times \frac{4}{3} = 50\frac{5}{3}$ oz.

41. $\frac{1}{8}$ mi. $= 7920$ in.; $7920 \div 14 = 565\frac{5}{7}$; that is, 566 tiles.

42. $\left. \begin{array}{l} \$18 : \$115 \\ 6 \text{ mo.} : 9 \text{ mo.} \end{array} \right\} :: \$300 : ();$

$$\frac{\$300 \times 115 \times 9}{18 \times 6} = \$2875, \text{ } \textit{Ans.}$$

43. $1\frac{1}{4}$ times the number lacks 20 of being double the number; then, $\frac{3}{4}$ of the number $= 20$; $\frac{1}{4}$ of the number $= 6\frac{2}{3}$; the number $= 4$ times $6\frac{2}{3}$, or $26\frac{2}{3}$, *Ans.*

44. At 5 o'clock the minute hand is 25 minute spaces behind the hour hand, and, therefore, if the hour hand were stationary the hands would be together at 25 minutes past 5. But the hour hand moves 1 space while the minute hand gains 11; therefore the hour hand has moved $\frac{1}{11}$ of 25 minutes, or $2\frac{3}{11}$ minute spaces further, and therefore the whole number of minute spaces traversed by the minute hand before they are together must be $25 + 2\frac{3}{11}$, or $27\frac{3}{11}$ spaces. That is, the hands will be together at $27\frac{3}{11}$ minutes past 5 o'clock, *Ans.*
45. Since the time required to travel the whole distance was 18 days, the second soldier had traveled $\frac{1}{2}$ the whole distance before the first turned back. And since the first turned back as far as the second had advanced at that time, he turned back $\frac{1}{2}$ the distance. This he walks back again, and, besides, completes the whole distance, thereby going over the ground *twice* in 18 days, traveling 12 miles per day. The second soldier travels the whole distance *once* in 18 days, and, therefore, his rate per day is $\frac{1}{2}$ of 12 miles, or 6 miles, *Ans.*
46. Since 30 men did half of the work in 40 days, it would have required them 80 days to do the work, or it would have taken 1 man 30 times 80, or 2400 days. To do half of the work would require 1 man 1200 days, and since the work had to be finished in 20 days, it would require as many men as 20 is contained times in 1200, or 60 men. Inasmuch as he had 30 laborers, he was obliged to hire $60 - 30$, or 30 laborers, *Ans.*

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47. $\frac{3}{4}$ of time past noon $= \frac{3}{4}$ of time to midnight;
 $\frac{1}{4}$ of time past noon $= \frac{1}{4}$ of time to midnight;
 The time past noon $= \frac{1}{4}$ of time to midnight. Therefore,
 the whole time from noon to midnight was $1\frac{1}{4}$ times
 the time to midnight. Therefore,
 $1\frac{1}{4}$, or $\frac{5}{4}$, of the time to midnight $= 12$ hr.;
 $\frac{1}{4}$ of the time to midnight $= 1\frac{1}{4}$ hr.;
 The time to midnight $= 6\frac{3}{4}$ hr. Therefore,
 The time past noon $= 12 - 6\frac{3}{4} = 5\frac{1}{4}$ hr.
 That is, the time was 20 minutes past 5 o'clock, *Ans.*
48. \$1 put at compound interest for 21 years at 6%,
 amounts to \$3.399564. Therefore, it will take as many
 dollars to amount to \$3000 in that time as 3.399564
 are contained times in \$3000. $\$3000 \div 3.399564 =$
 $\$882.46$, *Ans.*
49. August 11th was 21 days, or $\frac{7}{10}$ of a month, before the
 note was due. The use of any sum of money for that
 time at 6% is equal to $\frac{7}{1000}$ of it. The use of any
 sum for 60 days at 6% is equal to $\frac{1}{100}$ of it. There-
 fore, since he was to pay such a sum that the use of it
 for 21 days was to equal the use of the sum unpaid for
 60 days, $\frac{1}{100}$ of the sum unpaid $= \frac{7}{1000}$ of the sum
 paid. The whole of the sum unpaid $= \frac{700}{1000}$ of the
 sum paid. Therefore, $\frac{2000}{1000} + \frac{700}{1000}$, or $\frac{2700}{1000}$, or $\frac{27}{10}$
 of the sum paid $= \$100$; $\frac{1}{10}$ of the sum paid $= \$10$;
 and the whole sum paid $= 20$ times $\$10 = \200 ,
 the sum paid, *Ans.*

50. His first annual saving draws interest from the time he is 22 years of age until he is 40, a period of 18 years; his second saving draws interest for 17 years; his third for 16 years, etc. Therefore his annual savings form a geometrical series, decreasing uniformly until the last saving, which does not draw interest, is reached.

Since the last saving may be regarded as the first term, to find the value of an annual saving of \$1 it is necessary to find the sum of a geometrical series in which the first term is 1, the ratio 1.06, and the number of terms 19.

$$\text{The sum} = \frac{\$1.06^{19} - \$1}{\$1.06 - \$1}.$$

$\$1.06^{19}$ = the amount of \$1 at compound interest for 19 years. By referring to the compound interest table (Prac. Arith., p. 227), it is found to be \$3.0256.

$$\text{Then the sum} = \frac{\$3.0256 - \$1}{\$1.06 - \$1}, \text{ or } \$33.76.$$

Since an annual saving of \$1 would amount to \$33.76 in the given time, it will require an annual saving of as many times \$1 to secure \$25000 as \$33.76 are contained times in \$25000.

$\$25000 \div \$33.76 = \$740.52$. Therefore the annual saving is \$740.52, *Ans.*

51. Since he sold $\frac{3}{4}$ of the article for $\frac{7}{8}$ of the cost of it, he gained $\frac{1}{8}$ of the cost. Therefore, he gained $\frac{1}{8}$ on $\frac{3}{8}$, or $\frac{1}{3}$, or $16\frac{2}{3}\%$ of cost, *Ans.*
52. Since he sold $\frac{1}{2}$ the quantity for $\frac{5}{7}$ of the cost, he gained $\frac{5}{7} - \frac{1}{2}$ or $\frac{3}{14}$ of the cost. Therefore, he gains $\frac{3}{14}$ on an investment of $\frac{1}{2}$ the cost, or $\frac{3}{7}$, or $42\frac{3}{7}\%$, *Ans.*

53. Since $\frac{3}{4}$ of cost of horse = $\frac{2}{3}$ of cost of carriage,
 $\frac{1}{4}$ of cost of horse = $\frac{2}{3}$ of cost of carriage, and
 The cost of horse = $\frac{8}{3}$ of cost of carriage.

Since the cost of horse = $\frac{8}{3}$ of cost of carriage, the gain by the sale of horse was 25% or $\frac{1}{4}$ of $\frac{8}{3}$ of cost of carriage, or $\frac{2}{3}$ of cost of carriage. Therefore the selling price of horse was $\frac{10}{3}$ of cost of carriage.

Since the gain on the carriage was 10%, or $\frac{1}{10}$ of its cost, the selling price of carriage was $\frac{11}{10}$ of its cost. Therefore the selling price of both was equal to $\frac{10}{3}$ of cost of carriage + $\frac{11}{10}$ of cost of carriage, or $\frac{190}{30}$ of cost of carriage. Hence,

$$\frac{190}{30} \text{ of cost of carriage} = \$597,$$

$$\frac{1}{30} \text{ of cost of carriage} = \$3, \text{ and}$$

$$\text{The cost of carriage} = 90 \text{ times } \$3, \text{ or } \$270, \text{ Ans.}$$

$$\text{The cost of horse} = \frac{8}{3} \text{ of } \$270, \text{ or } \$240, \text{ Ans.}$$

54. If 300 cats kill 300 rats in 300 minutes, they kill a rat per minute, and therefore will kill 100 rats in 100 minutes. Therefore it will require 300 cats, *Ans.*

55. When 8 paid for the coach, each paid $\frac{1}{8}$ of the cost. If 12 had paid for it, each would have paid $\frac{1}{12}$ of the cost. Therefore, $\frac{1}{8}$ of the cost - $\frac{1}{12}$ of the cost = \$1, or $\frac{1}{24}$ of the cost of coach = \$1; the cost of coach = \$24, *Ans.*

56. If I had paid \$250 for the goods more than I did, they would have cost me 100% of original cost + \$250.

Since, by buying at this price, I would have lost 20% by the sale, the selling price was 80% of what they

would have cost, or 80% of (100% of original cost + \$250), which was 80% of original cost + \$200.

From the conditions first given, the selling price was 120% of original cost. Therefore,

$$\begin{aligned} 80\% \text{ of original cost} + \$200 &= 120\% \text{ of original cost;} \\ 40\% \text{ of original cost} &= \$200; \\ 1\% \text{ of original cost} &= \$5; \\ \text{Original cost} &= \$500, \text{ Ans.} \end{aligned}$$

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57. $\$1.25 \times 25 = \31.25 , am't he might have earned;
 $\$31.25 - \$19 = \$12.25$, am't lost in wages and board;
 $\$1.25 + \$.50 = \$1.75$, the daily loss;
 $\$12.25 \div 1.75 = 7$, the number of days idle, *Ans.*

58. A's age = 20 years; B's age = 20 years + $\frac{1}{2}$ C's age;
 C's age = 40 years + $\frac{1}{2}$ C's age. Therefore, $\frac{1}{2}$ C's
 age = 40 years; C's age = 80 years, *Ans.*

B's age = 20 years + 40 years = 60 years, *Ans.*

59. Since A received $\frac{2}{3}$ of the profits, his capital must have
 been $\frac{2}{3}$ of the entire capital. Therefore, $\frac{2}{3}$ of capital =
 $\$4500$; $\frac{1}{3}$ of capital = $\$1500$; entire capital = $\$7500$;
 B's capital = $\frac{1}{3}$ of $\$7500 = \3000 , *Ans.*

60. $\$2 + \$6 = \$8$, half of his money before he bought the
 clothing. Therefore $\$16$ was the amount of his money
 before he bought the clothing. $\$16 + 2 = \18 , half of
 what money he had after paying his traveling expenses.
 Therefore $\$36$ was what he had after paying his travel-
 ing expenses. $\$36 + \$4 = \$40$, half of his money.
 Therefore his money was 2 times $\$40$, or $\$80$, *Ans.*

61. Since 6 apples and 3 pears cost 21 cents,

(1) 12 apples and 6 pears cost 42 cents; and since

(2) 5 apples and 6 pears cost 28 cents, the difference between the cost of (1) and (2) must be the cost of the difference in the number of apples, since the number of pears is the same. Therefore 7 apples cost 14 cents, and 1 apple cost 2 cents, *Ans.*

Since 6 apples cost 12 cents, and 6 apples and 3 pears cost 21 cents, 3 pears must cost the difference between 12 cents and 21 cents, or 9 cents. Therefore, 1 pear cost 3 cents, *Ans.*

62. A and B can do $\frac{1}{20}$ in 1 day. Since A does $\frac{3}{4}$ as much as B, both do $\frac{1}{4}$ as much as B; and A does $\frac{3}{4}$ of the work, and B $\frac{1}{4}$ of the work. Therefore A does $\frac{3}{4}$ of $\frac{1}{20}$, or $\frac{3}{80}$, of the work in 1 day, and he would need as many days to do the whole as $\frac{80}{3}$ is contained times in $\frac{140}{80}$, which is $46\frac{2}{3}$ days, *Ans.*

B does $\frac{1}{4}$ of $\frac{1}{20}$, or $\frac{1}{80}$, of the work in 1 day, and would need as many days to do the whole as $\frac{80}{1}$ is contained times in $\frac{140}{80}$, which is 35 days, *Ans.*

63. By the conditions of the problem the payments are to include the interest accrued at the end of each year, together with a certain portion of the principal.

The principal for the first year will be \$5000. The payment at the end of the first year will be equal to the interest, \$300, and a portion of the principal.

The principal for the second year will be *less* than the principal for the first year by the value of the first portion paid, and therefore the amount of *interest*

to be paid at the *second* payment will be *less* than the interest paid at the first payment *by the interest for 1 year upon the first portion of the principal paid*, or 6% of the portion of the principal previously paid.

Hence, since the payments are to be equal, the portion of the *principal* to be paid at the *second* payment must be as much *more* than the previous portion as the interest is less than the previous interest; that is, it must be 6% more than the previous portion, or 1.06 of the previous portion.

Reasoning in the same way regarding the subsequent payments, the third portion of the principal paid will be 1.06 of the second, the fourth 1.06 of the third, the fifth 1.06 of the fourth.

Thus it is seen that the portions of the principal paid form a geometrical series in which the *ratio* is 1.06, the *number* of payments or *terms* 5, and the *sum* of payments \$5000. We wish to find the first term, which will be the portion of the principal paid the first time. This sum *plus* the first interest, \$300, will be the entire first payment; and since the payments are equal it will be the payment made each time.

According to rule first, in Geometrical Progression, the *last* or fifth term = first term $\times 1.06^4$. Using this value for the last term in rule second, we have

$$\frac{\text{first term} \times 1.06^5 - \text{first term}}{1.06 - 1} = \$5000, \text{ or simplifying the expression, } \frac{(1.06^5 - 1)}{.06} \times \text{first term} =$$

\$5000. Dividing by $\frac{1.06^5 - 1}{.06}$, the first term =

$\frac{\$5000 \times .06}{1.06^5 - 1}$, which is equal to \$886.98;

\$886.98, first portion of the principal paid, *plus* \$300, the interest, = \$1186.98, entire payment, *Ans.*

NOTE.— 1.06^5 is equal to the amount of \$1 at compound interest for 5 years at 6%, and may be found by reference to the compound interest table, *Prac. Arith.*, p. 227.

A general rule for the solution of this class of examples may be formed from the following:

Let P represent the principal;

Let p represent the payment;

Let r represent the rate per cent.;

$P \times (1 + r) =$ amount of principal for 1 year;

$P \times (1 + r) - p =$ amount due at end of first year, or new principal for second year. Multiplying this new principal by $(1 + r)$,

$P(1 + r)^2 - p(1 + r) =$ amount of principal at end of second year;

$P(1 + r)^2 - p(1 + r) - p =$ amount due at end of second year, or new principal for third year. Multiplying this new principal by $(1 + r)$,

$P(1 + r)^3 - p(1 + r)^2 - p(1 + r) =$ amount of principal at end of third year;

$P(1 + r)^3 - p(1 + r)^2 - p(1 + r) - p =$ amount due at end of third year, or new principal for fourth year.

By continuing the reasoning it may be shown that the amount due at end of fifth year may be expressed:

$P(1+r)^5 - p(1+r)^4 - p(1+r)^3 - p(1+r)^2 - p(1+r) - p$; and since the entire indebtedness was paid at that time,

$P(1+r)^5 - p(1+r)^4 - p(1+r)^3 - p(1+r)^2 - p(1+r) - p = 0$; therefore the sum of the subtrahends must equal the minuend, and

$p(1+r)^4 + p(1+r)^3 + p(1+r)^2 + p(1+r) + p = P(1+r)^5$, and

$p \left((1+r)^4 + (1+r)^3 + (1+r)^2 + (1+r) + 1 \right) = P(1+r)^5$. Therefore,

$$p = \frac{P(1+r)^5}{(1+r)^4 + (1+r)^3 + (1+r)^2 + (1+r) + 1}.$$

Substituting the numbers for the letters, the payment =

$$\frac{5000 \times 1.06^5}{1.06^4 + 1.06^3 + 1.06^2 + 1.06 + 1} = \$1186.98+, \text{ Ans.}$$

64. $\$300 \div 1.25 = \240 , the cost of one carriage;

$\$300 \div .75 = \400 , the cost of other carriage;

" $\$640$, the cost of both carriages;

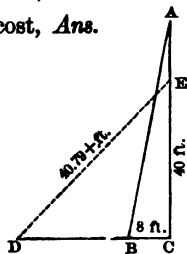
$\$300 \times 2 = \600 , the selling price of both carriages;

$\$40$, the loss by the sale, *Ans.*

The loss was $\frac{40}{640}$, or $\frac{1}{16}$, or $6\frac{1}{4}\%$ of cost, *Ans.*

65. $\sqrt{40^2 + 8^2} = 40.79 + \text{ft.}$, A B, the length of the ladder. Therefore, in the right-angled triangle DCE, CE is 30 ft., and DE is 40.79 + ft. Therefore,

$$\sqrt{40.79^2 - 30^2} = 27.64 + \text{ft.}, \text{ D C.}$$



66. Since Mr. A. is 35, and his son 10, Mr. A. was 25 years of age when his son was born, and will be 2 times 25, or 50 years of age when his son's age is half of his. And since he is 35 years of age now, the son will be half the father's age in 50 years — 35 years, or 15 years, *Ans.*

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67. Since he lacked 30 cents of having money enough in the first instance, and had 15 cents left in the second instance, the difference in the cost was 45 cents. The difference per pound was $\frac{1}{2}$ cent. Therefore 45 cents must have been the difference on 2 times 45, or 90 pounds, *Ans.*

68. Since $\frac{2}{3}$ of No. in 1st field = $\frac{2}{3}$ of No. in 2d field,
 $\frac{1}{3}$ of No. in 1st field = $\frac{1}{3}$ of No. in 2d field, and
 The entire No. in 1st field = $\frac{2}{3}$ of No. in 2d field.
 Since $\frac{1}{4}$ of No. in 3d field = $\frac{1}{4}$ of No. in 2d field,
 $\frac{3}{4}$ of No. in 3d field = $\frac{3}{4}$ of No. in 2d field, and
 The entire No. in 3d field = $\frac{3}{4}$ of No. in 2d field.

Therefore, since the number in the 1st field is $\frac{2}{3}$ of the number in the 2d field, and the number in the 3d field is $\frac{3}{4}$ of the number in the 2d field, the number in the three fields will be equal to $\frac{2}{3} + \frac{3}{4} + \frac{3}{4}$, or $2\frac{1}{2}$, of the number in the 2d field; and

$$2\frac{1}{2} \text{ of No. in 2d field} = 434;$$

$$\frac{1}{2} \text{ of No. in 2d field} = 2;$$

$$\text{Entire No. in 2d field} = 72 \text{ times } 2, \text{ or } 144;$$

$$\text{The No. in 1st field} = \frac{2}{3} \text{ of } 144, \text{ or } 162;$$

$$\text{The No. in 3d field} = \frac{3}{4} \text{ of } 144, \text{ or } 128, \text{ } \textit{Ans.}$$

69. A and B can do $\frac{1}{10}$ in 1 day; B and C can do $\frac{1}{12}$ in 1 day; A and C can do $\frac{1}{15}$ in 1 day; A, B and C can do $\frac{1}{2}$ of $(\frac{1}{10} + \frac{1}{12} + \frac{1}{15})$, or $\frac{1}{4}$, in 1 day.

Since A, B and C can do $\frac{1}{4}$, and A and B $\frac{1}{10}$, in 1 day, C can do $\frac{1}{4} - \frac{1}{10}$, or $\frac{1}{20}$, of the work per day, or he can do the whole in 40 days, *Ans.*

Since A, B and C can do $\frac{1}{4}$, and B and C $\frac{1}{12}$, in 1 day, A can do $\frac{1}{4} - \frac{1}{12}$, or $\frac{1}{6}$, per day, or he can do the whole work in 24 days, *Ans.*

Since A, B and C can do $\frac{1}{4}$, and A and C can do $\frac{1}{15}$, in 1 day, B can do $\frac{1}{4} - \frac{1}{15}$, or $\frac{1}{20}$, in 1 day, or he will require as many days to do the whole as $\frac{1}{20}$ is contained times in $\frac{1}{15}$, which is $1\frac{1}{3}$ days, *Ans.*

70. Since the field contains 24 acres, each man's cattle would eat $\frac{1}{3}$ of the 24 acres, or 8 acres. Since A owned only 9 acres, and his cattle ate the grass upon 8 acres, he really furnished only 1 acre for the pasturage of C's cattle. B furnished $15 - 8$, or 7 acres. Therefore, since A furnished 1 acre and B 7 acres, A is entitled to $\frac{1}{8}$ of the sum paid by C, or $\frac{1}{8}$ of \$24, which is \$3; and B is entitled to $\frac{7}{8}$ of \$24, or \$21, *Ans.*

71. Since the boards are 11 ft. long, and fence 4 boards high, the number of boards in a rod would be equal to 6.

Since the field is a square field, and the number of boards per rod is 6, the number of boards needed to inclose the field will be 24 times the number of rods in the length of one side.

The number of acres is equal to the square of the number of rods in length divided by 160.

And since the number of acres and the number of boards are equal, we have the following equation:

$$\text{Rods in length} \times 24 = \frac{(\text{rods in length})^2}{160}; \text{ therefore,}$$

$$24 = \frac{\text{rods in length}}{160}; \text{ and}$$

$$24 \times 160 \text{ or } 3840 = \text{rods in length};$$

$$24 \text{ times } 3840 = 92160 \text{ acres, } \textit{Ans.}$$

72. Since the numbers have a common factor plus the same remainder, if the numbers are subtracted from each other the results will contain the common factor without the remainder. Thus:

| | | | | |
|----------|----|----|----|-----|
| | 27 | 48 | 90 | 174 |
| | | 27 | 48 | 90 |
| 1st set: | | 21 | 42 | 84 |
| | | 48 | 90 | 174 |
| | | 27 | 27 | 27 |
| 2d set: | | 21 | 63 | 147 |

The greatest common divisor of these numbers is 21.

73. A's present stock is $1\frac{1}{2}$ times the original amount, B's stock was $\frac{1}{2}$ of A's present stock, or $\frac{3}{4}$ of A's or B's original stock. Therefore,

B's loss was equal to $\frac{3}{4}$ of A's or B's original stock;

$\frac{3}{4}$ of A's or B's original stock = \$225;

$\frac{1}{4}$ of A's or B's original stock = \$75;

A's or B's original stock = \$600, *Ans.*

74. Since, if he left only a daughter, the wife was to have $\frac{3}{4}$ and the daughter $\frac{1}{4}$, the wife's share was to be 3 times the daughter's; and since, if he left only a son, the wife was to receive $\frac{1}{4}$ and the son $\frac{3}{4}$, the son's share was to be 3 times the wife's; when the daughter gets \$1, the wife gets \$3, and the son gets \$9.

Therefore, the daughter gets $\frac{1}{18}$ of the sum, the wife $\frac{3}{18}$, the son $\frac{9}{18}$.

$\frac{1}{18}$ of \$6591 = \$507, the daughter's share;

$\frac{3}{18}$ of \$6591 = \$1521, the wife's share;

$\frac{9}{18}$ of \$6591 = \$4563, the son's share, *Ans.*

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